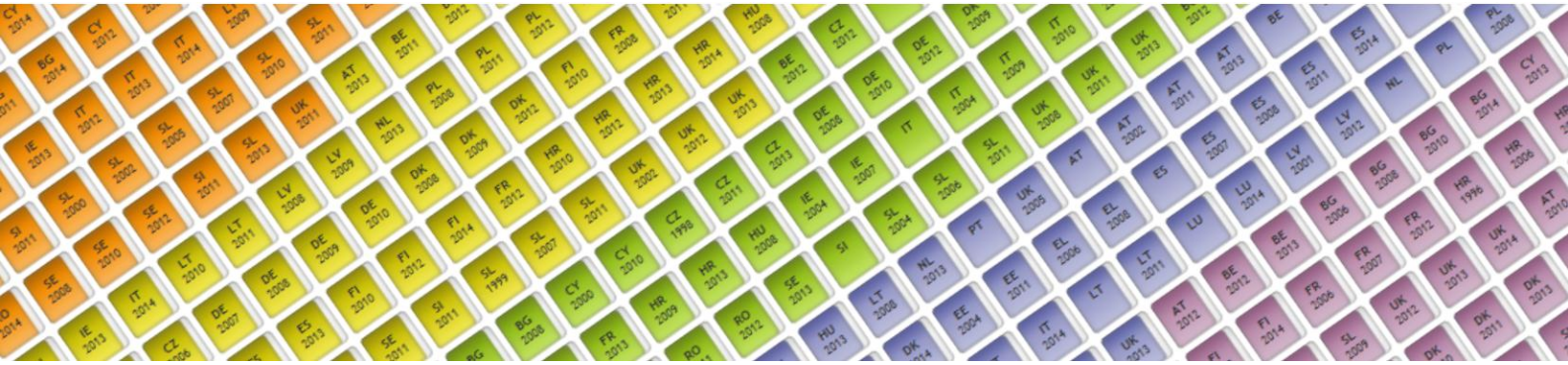
European Commission

JRC SCIENCE AND POLICY REPORT

RIO Country Report Portugal 2014

Manuel Mira Godinho & Vítor Corado Simões

2015



Report EUR 27313 EN

Joint Research Centre

European Commission
Joint Research Centre
Institute for Prospective Technological Studies

Contact information
Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)
E-mail: jrc-ipts-secretariat@ec.europa.eu
Tel.: +34 954488318
Fax: +34 954488300

JRC Science Hub
https://ec.europa.eu/jrc

JRC 96476

EUR 27313 EN

ISBN 978-92-79-49002-6 (PDF)

ISSN 1831-9424 (online)

doi:10.2791/584

Luxembourg: Publications Office of the European Union, 2015

Abstract

The report offers an analysis of the R&I system in Portugal for 2014, including relevant policies and funding, with particular focus on topics critical for two EU policies: the European Research Area and the Innovation Union. The report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The report identifies the structural challenges of the Portuguese research and innovation system and assesses the match between the national priorities and those challenges, highlighting the latest policy developments, their dynamics and impact in the overall national context.

Acknowledgments

The report draft has benefited from comments and suggestions of Madalena Antunes Pereira from the Foundation for Science and Technology (FCT) and of Jana Zifčiaková from JRC-IPTS. The contributions and comments from DG RTD and JRC-IPTS are also gratefully acknowledged.

Executive summary

This report provides an overview of the main policy developments that occurred in 2014 in Portugal's research & innovation system (R&I), including funding. It also examines developments regarding two key EU policies: the European Research Area, and Innovation Union. The report was prepared according to a set of guidelines that have been established for collecting and analysing a wide range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative and qualitative data is, whenever possible, comparable across all EU Member States' reports.

The harsh economic climate and the austerity programme have had an impact on the evolution of R&D expenditures. According to the latest data published by the Ministry for Education and Science, the GERD/GDP ratio has maintained a declining trend, from 1.58 % to 1.37% between 2009 and 2012. Universities in particular, have been faced with significant budgetary constraints and have not been able to maintain their previous levels of research activity, which has led to the continued decline of their contribution. The BERD/GDP ratio has also steadily dropped, from 0.75 to 0.68 % between 2009 and 2012.

In this context, Portugal is facing significant challenges with regards to its R&I policy and activities. The macroeconomic and business climate has been marked by more than three years of austerity. Whilst some signs of turnaround in the medium-term GDP trend are starting to be seen, the results of the austerity policy have led to a rise in poverty and emigration. Portugal needs a vision together with adequate actions to bring the country out of the recession and to move forward. There is widespread agreement that research and innovation are essential to build such a future; however a consensual mobilising agenda has been lacking. These issues are especially acute now, as Portugal is facing a turning point. The end of the Economic Adjustment programme that was formally negotiated with the EC, ECB and IMF, together with agreement regarding a new round of European financial support, which was translated into the Portugal 2020 Partnership Agreement for the period 2014-2020, both provide an opportunity to improve R&I policy in an incremental way.

The report shows that 2014 brought both good and bad news for R&I policy. The bad news mostly concerns the inability to keep a consensus between public policy-making organisations and the scientific community. The existing common understanding with regards to research policy has been jeopardised, as some recent science policy actions have led to the exclusion of significant segments of the scientific community. Another problem is that of the supply-side bias which underscores some of the policy initiatives on 'knowledge and technology transfer' which were included in Portugal's National Reform Programme for 2014.

To the contrary, there have been positive developments in several areas. Firstly, the Portugal 2020 Partnership Agreement formally sets out the commitment to promote R&I activities as an essential tool for fostering competitiveness and sustainability. Secondly, there is widespread agreement, which is clearly expressed in the various evaluations of the National Strategic Reference Framework 2007-2013, that the existing R&I policy-mix only requires incremental improvements, and not revolutionary change. Although the specific policy measures have not been disclosed so far, an incremental approach will very likely be followed. Thirdly, a R&D Strategy for Smart Specialisation has been designed in a participatory way, which involves key stakeholders at both national and regional levels. This led to the design of a policy mix and a matrix of territorial dimensions of thematic

priorities, as well as to the definition of a governance model and monitoring and evaluation instruments. Fourthly, and related to this, there are signs of increased inter-Ministerial cooperation in designing and implementing R&I policy, which suggests that the gap between the Ministry for Education and Science and the Ministry for the Economy is now being bridged; however, the former appears to be in the driving seat, which creates the risk of a supply-side bias, as mentioned above. Fifthly, it was decided to establish the Agência Nacional de Inovação, S.A. (ANI), thus ending a long period of political indecision regarding the former Agência de Inovação. Sixthly, an open-access policy has been disclosed, and despite doubts about its immediate enforceability, it may well in the long term have a significant impact. Finally, the Portugal 2020 Partnership Agreement will enlarge the room for the involvement of regional authorities in R&I policy, and, in spite of the risks of fragmentation and the overlapping of small scale initiatives, this development is positive, as it could possibly reduce centralisation and increase the closeness between public administration and economic players.

The main challenges faced by the Portuguese R&I system are discussed in detail in the report. There are two new public policy challenges which need to be addressed: the cohesiveness of the research system and the risk of a too long interim period before the new Portugal 2020 Partnership Agreement becomes fully operational. Therefore, the following challenges are highlighted:

- Ensuring the sustainability of the research and innovation system;
- Maintaining the trend of improving strategic policy design, systemic density and coordination among the key players in R&I;
- Maintaining the levels of cohesiveness and dialogue amongst the players in the research system, whilst improving levels of trust and the capacity to collaborate in challenging endeavours;
- Implementing the Smart Specialisation approach in a consistent manner, whilst avoiding a supply-side bias;
- Achieving a fast regulation of the policy measures of the Portugal 2020 Partnership Agreement, in order to avoid an excessively lengthy implementation period of the key measures that concern the players in the R&I system (including the reorientation of clustering initiatives);
- Stimulating the emergence of new companies, both domestic and foreign-owned, particularly in knowledge intensive activities;
- Strengthening the development of SMEs' in-house technological, organisational and marketing capabilities, with a view to making them more prepared to compete in international markets.

The Competitiveness and Internationalisation Operational Programme (CIOP) will be an essential instrument for the response to such challenges, and it will provide for interaction between national and regional levels. Though the operationalisation of the measures included in the CIOP is already underway, the approach broadly followed in designing the Programme is going in the right direction. However, important as it may be, the existence of an appropriate R&D policy-mix is not sufficient to ensure the structural change that the Portuguese economy needs to undergo (Mamede, Godinho & Simões, 2014). The

evaluations of the relevant NSRF 2007-2013 OPs indicated that the policy toolbox for R&I policies is relatively complete.

However, policy changes in other areas are required to generate synergies and to bring about structural change and a more balanced economy. There is a need to improve policy governance and policy consistency. Without an improved access to credit, company investment projects may be put into jeopardy and without a committed and professionalised innovation-orientated (and not just public income-orientated) foreign investment policy, structural change will not be achieved. Furthermore, until an overall policy is implemented for designing an agenda for growth and sustainable economic development with the involvement of the main stakeholders, area-specific measures will not be enough to ensure a sustained improvement of competitiveness.

TABLE OF CONTENTS

1. Overview of the R&I system

1.1 Portugal in the European RDI landscape

With 10.5 million inhabitants, Portugal has a 2.1% share of the EU population. In terms of GDP, its share is smaller, standing at 1.26% in 2013, down from 1.40% in 2011. These figures translate into a GDP per capita (in purchasing power parity) which is equivalent to 75% of the EU's 2013 average (in 2009 it was 80%). The growth trend of GDP has been negative, being -2.9% in 2009, 1.9% in 2010, -1.3% in 2011, -3.2% in 2012, and -1.4% in 2013 (Eurostat data, accessed December 2014). The European Economic Forecast Spring 2014 of May 2014 foresaw a change in trend, with expected GDP growth rates of 1.2% in 2014, and 1.5% in 2015. However, the European Economic Forecast Autumn 2014 of November 2014 provided a less favourable perspective, with expected GDP growth rates of 0.9% in 2014, and 1.3% in 2015. In accordance with the forecasts made in November of 2014, Portugal will keep falling behind the Euro-area respectively by 0.4%, 0.2% and 0.3% over the next three years, thus deepening the divergence trend that has been going on for more than a decade now.

Until the beginning of the recession, the overall trend in terms of R&D investment was quite positive. By 2009 Portugal had reached a GERD/GDP ratio of 1.58 %, with the private sector becoming the most important R&D performer since 2007, boasting a 47.0% BERD/GERD share in 2009. However, after 2009, R&D has followed the overall macroeconomic trend. By 2012, the Portuguese GERD (Gross Expenditure in Research and Development) was € 2320.1 m, which was the equivalent to 1.37% of GDP, down from 2009, 2010 and 2011, when GERD was respectively € 2771.6 m, € 2757.6 m and € 2566.4 m.

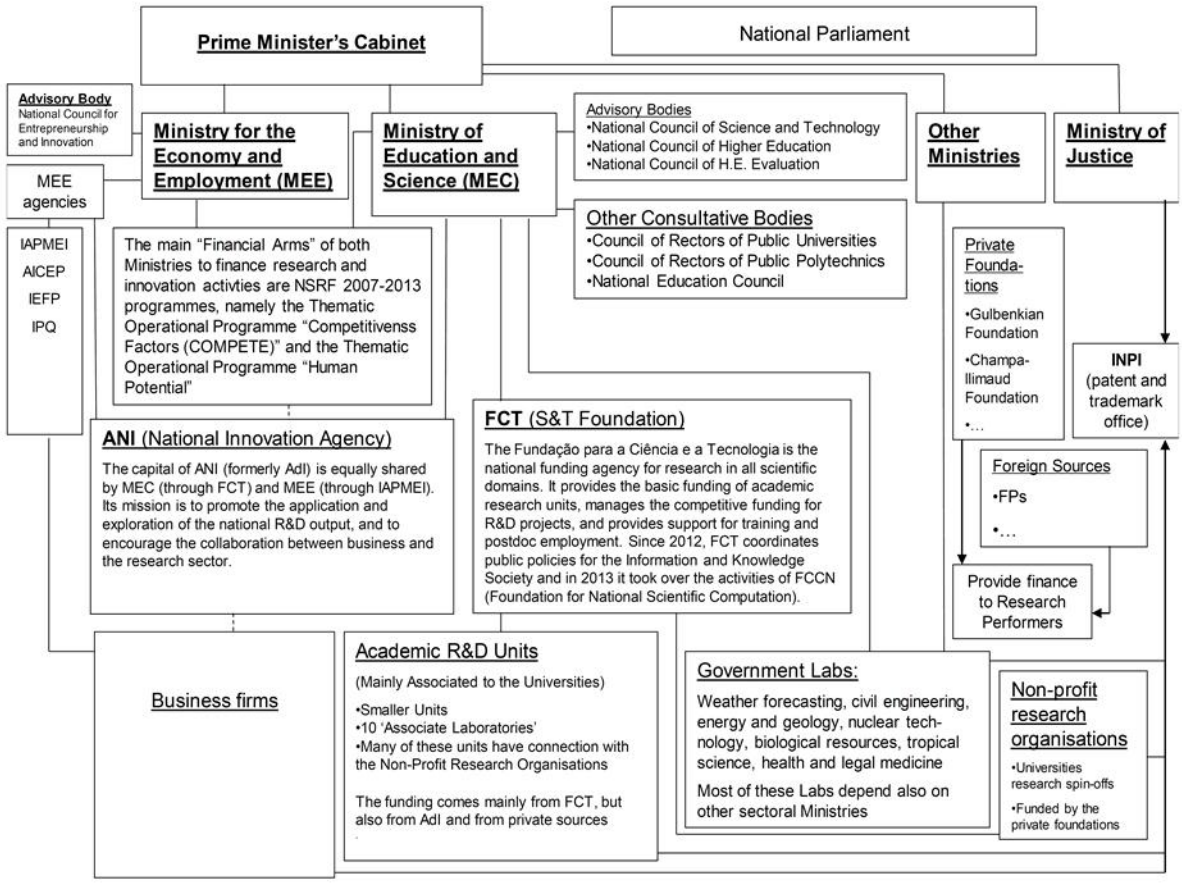
1.2 Main features of the R&I system

Notwithstanding a rising BERD/GERD share over the 2000s decade, R&D governance is still largely dominated by the public sector. The research system has been marked by a high degree of centralisation, through fund allocation and political coordination. The regions have had a minor role in the allocation of research funds. This situation has been changing though, as an increasing part of those structural funds dedicated to research have been allocated to the regional operational programmes (OPs). In 2014, 15.2 % of the GBAORD allocations were for the 5 continental regional Ops, plus the two Atlantic regional OPs. National R&D budgets are not announced annually ex-ante, together with the preparation of the national government budget, but they are rather presented as an ex-post accounting exercise. At €1,626m in 2014, the government budget appropriations or outlays for R&D were 8% below the level of 2010, when they had reached a historical high at €1,768 m. It has to be further pointed out that, despite the ex-post nature of the R&D budget exercise, a significant difference has occurred in relation to the actual amount of GERD financed by government funds. For 2012, which was the last year for which data is available, the gap between the announced GBAORD (€1,754m) and the GERD actually carried out with public funds (€1,001m) was 43%, which compares with a corresponding 2% gap for the EU overall during the same year.

.

1.3 Structure of the national research and innovation system and its governance

Figure 1: Portugal's RDI governance system



As seen in the organisation chart displayed above, which refers to October 2014, the research system is organised in three levels. The first level (the political level) contains the Prime Minister's Office and the main ministries in charge of supporting R&D: the Ministry for Education and Science and the Ministry for the Economy. Other sectorial ministries, including the Agriculture, Health, Environment, Foreign Affairs and Defence ministries, also allocate funds for R&D, but their importance in R&D funding is not comparable. The second level (the operational level) is comprised of the managing bodies of the main operational programmes that provide funds for research, together with the major executive agencies. Finally, the third level (research performers) displays those entities that actually perform R&D activities, namely academic R&D units and public laboratories. Those organisations that provide advice to the Ministry for Education and Science are also displayed. The Parliament is not formally connected in the organisation chart with the remaining sectors, as this political body has had a limited role in discussing and defining policy objectives in the area of S&T.

The main funding agency has been FCT (The Foundation for Science & Technology). Within the portfolio of its activities, FCT provides funding for: graduate education (grants) and

career development (contracts), R&D projects, R&D Institutions (Associate Laboratories, R&D Units), international cooperation (bilateral cooperation, membership of international organisations and international partnerships), and other activities.

The Agência Nacional de Inovação, which until Sept. 2014 was known as AdI (Agência de Inovação), has also a role in funding applied research. It is managed together by the two ministries portrayed in the organisation chart. Its main purpose is to stimulate the R&D and the technology absorption by business firms, together with establishing university-industry consortia. The main source of the funds it manages comes from the Operational Programmes

The government R&D sector has been shrinking in relative weight over recent decades and presently (2012) it only accounts for 5 % of total GERD. The dominance of public R&D up until the early 1980s was replaced by a rise of the share of the higher education sector, which reached 43% in 1992. However since then, HERD went down to 30% in 2007, when BERD reached a historical maximum of 51%. Meanwhile, in recent years, the higher education sector has regained a certain prominence, with HERD accounting for 36% of GERD in 2012.

On the business side of R&D activities, the top 10 companies invested a total of € 501m in intramural R&D in 20111, which accounts for 44% of total intramural BERD for that year. The Portugal Telecom group led this ranking, with an investment of €208 m, followed by BIAL (a pharma company), Nokia Siemens Networks Portugal and the Sonae group (distribution, real estate and manufacturing), with investments of €55m, €49m and € 47m respectively. Immediately next was BCP (Banco Comercial Português), with an investment of €40m, and Grupo José de Mello, SGPS, S.A., with €31m. The fact that two banks are amongst the top ten business R&D performers is an extraordinary situation, which is in part related to the low weight of the high-tech sector in Portugal, and also due to the weight of the financial services sector in the productive structure.

Main Changes in 2009
National Foresight Programme *Government announcing plans for a wide-ranging science and higher education reform and increases science budget*
Main Changes in 2010
Legislative reform of the science sector *Establishment of NCN (fundamental research funding agency)* *Empowerment of NCBiR (applied R&D funding agency)*
Main changes in 2011
Legislative reform of the higher education sector *Adoption of National Research Programme (KPB), defining strategic R&D directions* *Establishment of the Polish Roadmap for Research Infrastructures (PMDIB)*
Main changes in 2012
Implementation of the science and higher education reforms from 2010-2011
Main Changes in 2013
Adoption of high-level policy document – the Strategy for Innovation and Efficiency of the Economy (SIEG) *First nation-wide institutional assessment of scientific institutions based on new rules* *Adoption of draft Operational Programmes 2014-2020 by the government* *Multiple new R&D programmes launched by NCBiR, targeting identified funding gaps*
Main changes in 2014
Adoption of Enterprise Development Programme (PRP) and National Smart Specialisations (KIS) *Definition of smart specialisations by 16 regions* *Relaxing public procurement regulations for R&D at PHEIs and PROs* *Legal amendments facilitating the assignment of IPRs to inventing scientists* *Amendment of government support programme for FDIs to attract R&D-based investments*

2. Recent Developments in Research and Innovation Policy and systems

2.1 National economic and political context

The Portuguese economic and political context continues to be characterised by austerity and slow growth. Although the programme stemming from the memorandum of understanding with the European Commission, the European Central Bank and the International Monetary Fund formally came to an end in May 2014, the process of economic adjustment is still being pursued. Public deficit has been reduced (4.9% of GDP, or 4.5% excluding bank recapitalisations, for 2013; the target for 2014 is 4.0% of GDP), however the forecast for 2015 is slightly above the target negotiated with the EC (2.7 against 2.5%). Exports (link accessed on 24 February 2015) were the main engine for recovery in 2013, reaching 40.7% of GDP, but in 2014 export growth declined.

The unemployment rate (link accessed on 24 February 2015) declined to 14.1% in 2014, from 16.4 in 2013. A key concern is the high rate of youth unemployment, which, whilst improving with regard to 2013, still represents a very high rate, in spite of significant levels of youth emigration, which reached 34.7% in 2014.

The adjustment programme has been accomplished by and large, with changes in many sectors, ranging from the labour market to fiscal policy. However, some changes did not amount to a thorough revision and balancing of the system, an example being the case of fiscal policy. In this field, changes have been led by short term budgetary considerations, but not by long term equity concerns. The revamping of the banking system is still trailing behind, and one of the biggest Portuguese banks was subject to intervention by the Bank of Portugal in mid-2014.

Meanwhile, poverty increased (European Commission, 2014a), which has generated tensions with regard to social cohesion. A proportion of young skilled people has left the country to find job opportunities elsewhere, both in Europe, especially in the United Kingdom, and in Germany, and also outside Europe. The Portuguese population is losing its confidence in the political and economic elite, as the President of the Portuguese Republic has underlined in a recent speech (link accessed on 24 February 2015). A clear vision for the future, capable of mobilising the population after more than three years of harsh austerity is lacking.

2.2 National R&I strategies and policies

Historically, Portugal's R&I strategies have been marked by the framework defined by the successive Community Support frameworks, which have defined both the key policy measures and also provided the financial means to implement them. From this standpoint, 2014 heralds a transition from the National Strategic Reference Framework of 2007-2013 (NSRF 2007-2013) to the Portugal 2020 Partnership Agreement, which will run between 2014 and 2020. The Operational Programmes (OPs) under Portugal 2020 were published in December, 2014. The main OP that deals with R&I strategy and policy is the CIOP, whose headlines are presented below.

This being said, there is a wide consensus about the fact that in broad terms Portugal has pursued a positive trajectory in terms of research and innovation policies since the mid-

1980s. There is a perception that the existing set of policy measures followed on from the NSRF 2007-2013 framework is generally appropriate, and that it should be broadly kept in the new programming period of 2014-2020 (IESE/Quaternaire, 2013). A similar perspective is dominant with regards to research policy. This does not mean, however, that improvements are not welcome. On the contrary, they are badly needed, as pointed out by the various evaluations. One of the fields where a thorough policy revision is required is that of clustering policy (SPI, 2013). The message has therefore been the following: build upon the existing R&I policy framework, improving it incrementally, whilst at the same time avoiding abrupt changes and disruptions.

There is no central structure in charge of the coordination of R&I policy. There are several high level consultative councils (the National Council for Science and Technology, the National Council for Entrepreneurship and Innovation, and the National Council for Reindustrialisation), but coordination between them is limited. Over the last three years, the gap between the two main public players in R&I policy, the Ministry of Economy and the Ministry of Education and Science, has been partly bridged, which has enabled increased coordination. The process of defining an R&I strategy for Smart Specialisation (see 2.6 below) is a good example of inter-governmental and national-regional coordination, which included consulting stakeholders. However, this has not been the usual procedure in Portugal as policy is often designed *en petit comité* at the top. Many analysts of R&I policy in Portugal, including the authors of this report, have underlined the need for increased coordination and have made the case for setting up an effective top-level coordination structure for R&I policy (see, for instance, Godinho & Simões, 2005; Laranja, 2012, Mamede, Godinho & Simões, 2014).

In practical terms, the main instruments for ensuring a predictable policy and budgetary framework have been the successive multi-annual European support frameworks. As mentioned above, these have defined the headlines for R&I policy since the late 1980s. The headlines for the 2014-2020 programming period, agreed in the Partnership Agreement entered into with the European Commission, labelled as Portugal 2020, acknowledge and underline the role of R&I policy in promoting the country's competitiveness and internationalisation[1]. This is aligned with EU priorities. An R&I strategy for Smart Specialisation has been defined, which encompasses both regional and national levels, following an initial SWOT exercise (link accessed on 24 February 2015) of the R&I system undertaken by the Fundação para a Ciência e a Tecnologia (FCT, 2013). The key thematic priorities are detailed in section 2.6 (Smart Specialisation) below. Another positive development, also in line with EU priorities, is the ongoing work to use the preparation of the Portugal 2020 Partnership Agreement as a launch pad to build a general, pluriannual budget for R&I policy, encompassing both national and European funding sources.

Portugal 2020 is comprised of four thematic Operational Programmes (Competitiveness and Internationalisation; Social Inclusion and Employment; Human Capital; and Resource Efficiency and Sustainability), and seven regional Operational Programmes (OPs). In terms of R&I policy, the most important OP is that of Competitiveness and Internationalisation, although the Human Capital OP also provides a relevant contribution with regards to education, training and lifelong learning. Furthermore, the Regional OPs included policies which are directly addressed to the promotion of research and innovation in the regions concerned.

[1] Link accessed on 24 February 2015

The Competitiveness and Internationalisation OP (CIOP) is aimed at addressing the three main constraints that currently hinder Portugal's economic competitiveness and internationalisation: the specialisation profile; SMEs' skills and strategies, and; the contextual conditions that hinder companies' activities. The CIOP has five key thematic objectives: Strengthening research, technological development and innovation; improving the access to, use and quality of ICTs; strengthening SMEs' competitiveness; promoting sustainable transportation, and; strengthening the public administration's institutional capabilities and efficiency. The Thematic Objective 1 (TO1), which deals with R&I, is the most relevant for our purposes. It addresses five main strategic objectives:

- To increase scientific output with international recognition, aligned with smart specialisation;
- To promote the transfer of scientific and technological knowledge to the business enterprise sector;
- To increase the level of business enterprises R&D investment, as well as to strengthen the linkages between firms and other organisations of the R&I system, whilst promoting the development of knowledge intensive economic activities and innovation-based value creation;
- To strengthen networks and other partnership and cooperation modes that are aimed at promoting the innovation and internationalisation of firms and value chains (clustering), and;
- To increase business enterprises investment in innovative activities.

TO 3 (Strengthening SMEs' competitiveness) is also expected to promote innovation, namely in the following fields: promotion of skilled and creative entrepreneurship; strengthening of company internationalisation capabilities, including business model innovation, and; strengthening SMEs' capabilities to develop new goods and services.

Besides the setting up of the Portugal 2020 Partnership Agreement and the Operational Programmes mentioned above, other R&I policy initiatives deserve mentioning. In the research field, three relevant initiatives were being led by FCT in 2014: the conclusion of the initiative to definite a R&I strategy for Smart Specialisation (Government of Portugal, 2014a); the process of developing a National Roadmap for Research Infrastructures, in line with the ESFRI Roadmap, and; the launching of an evaluation of R&D units. The first initiative will be presented in detail in section 2.6 (Smart Specialisation) below.

The National Roadmap for Research Infrastructures has now been completed. FCT received 121 eligible applications which were subject to evaluation, taking into account their scientific merit and strategic relevance. The evaluation process led to the recommendation to merge or integrate several applications. The final results (link accessed on 24 February 2015), after the evaluation and audience of the applicants, were disclosed in July 2014 and 40 research infrastructures were recommended for inclusion in the National Roadmap, after mergers and integrations. Of these, 23 research infrastructures were considered to be aligned with ESFRI. Almost one half of the selected infrastructures fall into two scientific fields: Physics and Engineering Sciences, and Medical and Biological Sciences. This is the outcome of a long process, which started in 2012, which aimed to change Portugal's involvement in ESFRI roadmapping.

The third initiative concerns the international evaluation of R&D units. The last evaluation exercises were carried out in 2007 (R&D Units) and 2008 (Associated Laboratories). However there was a clear need to undertake a new evaluation, which followed the Regulation published in 2013 (link accessed on 24 February 2015), whose headlines were presented in the Portugal Country Report of 2013 (Godinho & Simões, 2014b). The evaluation concerned all R&D units, including Associated Laboratories.

Whereas previous evaluations had been coordinated and implemented by FCT itself, with the involvement of national and international experts, this time FCT assigned the evaluation to the European Science Foundation (ESF), under a service agreement. Although FCT argues that the evaluation followed "the most rigorous international patterns" (link accessed on 24 February 2015), this process generated a very strong reaction from a broad segment of the Portuguese scientific community. The main criticisms raised by the scientific community concerned the following: (1) the biases of the abovementioned Regulation; (2) an insufficient contextual knowledge of the evaluators; (3) the lack of specialists in some of the evaluation panels (namely in the case of Physics), and; (4) the fact that, contrary to a statement by the President of FCT, the work plan annexed to the service agreement established a quota of R&D units for entry to the second phase of the evaluation ("Stage 1 evaluation will result in a shortlist of half of the research units that will be selected to proceed to Stage 2").

The President of FCT gave a press interview, in which he argued in favour of the approach, pointing out that it is just institutional funding that is at stake, and not project funding. The pruning of the system in order to foster excellence is pointed out by the President of the National Council for Science and Technology as being one of the merits of the evaluation (Expresso, August 9, 2014). However, there has been wide criticism of the method, procedure and results of the evaluation by scientific associations (Physics, Chemistry, Mathematics, Philosophy), trades unions, and even the CRUP (Council of Rectors of Portuguese universities) and also the rectors of several universities, including Universidade de Lisboa. He made a plea in favour of a "revision of the essence of the evaluation process (...), since such a process should have been launched with no *a priori* definition that one half of the research units will disappear".

The results of the evaluation process were disclosed by FCT in December 2014 (link accessed on 24 February 2015). Out of the 322 R&D units subject to evaluation, 167 (51%) were ranked as Very Good (104), Excellent (52) or Outstanding (11), thus being eligible for institutional funding. The total amount of funding to be assigned is about €70m, €13m of which will be assigned to the 11 units that were classified as Outstanding and a further €6m will be distributed as strategic restructuration funding to some of the R&D units that were ranked as Good.

This issue, together with an earlier problem regarding the assignment of research grants, which led the National Council for Science and Technology to express some criticism about the approach followed by FCT, show that there is "an insufficient capacity to design and implement, in a participatory way, a new science policy" ('Highlights of Recent Research Policy Developments in Portugal' country page in the ERAWATCH website, link accessed on 24 February 2015).

Another relevant policy move has been the creation of the Agência Nacional de Inovação (National Innovation Agency – ANI). After a long and troubled process which started with

the decision to integrate the former Innovation Agency (AdI) in IAPMEI, the State institute for business investment and the government's[2] decided to continue AdI, and to re-launch it as a new public agency with responsibility for innovation issues- ANI. ANI is a 50%-50% joint venture between the Ministry for Education and Science (through FCT) and the Ministry for the Economy (through IAPMEI). ANI's mission is to work as "a platform to promote the alignment between R&D, innovation and technology-based entrepreneurship, in science and economy fields, aimed at promoting the valorisation of knowledge, namely through an increased and improved collaboration between companies and the National Scientific and Technological System[3]. According to the President of ANI, who took office in October 2014, "there is a pressing need to increase the proximity between science and the economy, and ANI will focus on the development of that relationship" (link accessed on 24 February 2015).

Traditionally, Portugal had a generic approach to R&D policy, with very limited thematic funding. This approach is changing now, namely as a result of the priorities defined in the context of the R&I strategy for Smart Specialisation. For the moment, it is difficult to fully grasp its implications in terms of funding allocation.

With regard to specific policies addressing societal challenges, there has been an increased concern with green growth and climate change. In February 2014, a Colligation for Green Growth was launched. This involves around 70 organisations (business and professional associations; foundations and NGOs; Universities and R&D centres; banks and financial companies; and the State and Public administration). The Colligation's mission includes the promotion of collaboration between public organisations, R&D centres and companies, to develop a green growth agenda (Governo de Portugal, 2014c).

The initiatives mentioned above are in line with the Government's overall strategy for R&I and they represent no major changes with regards to the previous year. The troubled evaluation of R&D units occurred as a result of the headlines defined by the Regulation, which was clearly oriented towards the selection of R&D units and the need to curb expenditures to meet budgetary constraints. Similarly, the linear approach to R&I policy remains dominant in policy statements. There is the intent to stimulate the cooperation between R&D Centres and Industry, but the tone is more linear than systemic. Nevertheless, the set of policy measures, namely in the context of the 'Compete' programme, under the former NSRF 2007-2013, has been recognised as being in line with a systemic approach to R&I policy (IESE/Quaternaire, 2013). Such a set of measures is expected to be kept in the new Competitiveness and Innovation OP, under the Portugal 2020 Partnership Agreement.

2.3 National Reform Programmes 2013 and 2014

Portugal's National Reform Programme (NRP), 2013, pointed out the need for strengthening Research, Development and Innovation (R&D&I) as being one of the main objectives. The document entitled 'Estratégia Europa: Ponto de Situação das Metas de Portugal', dated April 2013, provided an assessment of the results achieved in this field (Governo de Portugal, 2013). The decline in the R&D expenditures/ GDP ratio between 2009 and 2011 was acknowledged (Governo de Portugal, 2013). A similar reference was

[2] For a discussion on the earlier phases of the process, see Cooke & Simões (2013).
[3] http://www.adi.pt/.

made in the Commission's assessment of Portugal's 2013 NRP, which points out that the ratio recorded for 2011 was very far from the 2.7%-3.3% target that has been established for 2020. Taking into account the recent declining trend in R&D expenditure, budgetary constraints, the characteristics of Portugal's economic fabric and the limited capability to attract R&D intensive foreign investment, even the 2.7% target is too optimistic (Godinho & Simões, 2014b).

As mentioned in this report, the objectives established for the field of Research, Development & Innovation (R&D&I) suggest that the approach is very much based on a linear model perspective. No initiatives to encourage innovation in companies are mentioned in this document, with the exception of the intention to change the policy towards the Competitiveness and Technology Poles (CTP), and also the Technology Transfer approach. This unveils a science-driven view, which does not correspond with the process as to how knowledge creation takes place in the majority of companies, especially SMEs (Laranja, 2012; Cooke & Simões, 2013).

The 2014 NRP (Governo de Portugal, 2014c) adopts similar lines. A reference is made to the development of "a smart strategy for a competitive economy", which is based on investment in Education and R&D&I, which are considered to be key elements for the enhancement of human capital and, therefore of productivity. Such a smart strategy stems from the above mentioned initiative led by FCT to design a R&I strategy for Smart Specialisation. This was approved by a joint decision of the Secretaries of State of Regional Development, Innovation, Investment and Competitiveness and of Science, on the 23rd of December, 2014 and it is explained in detail in section 2.6, below. As in the 2013 NRP, the strengthening of R&D&I is highlighted as a central objective. A reference is made to the 2.7 % R&D to GDP target for 2020 and the commitment to maintain this policy is in line with the priorities of the 'Europe 2020 Strategy'.

The document presents a set of "emblematic initiatives" which are designed to strengthen R&D&I, some of which were already mentioned in the 2013 NRP, namely:

- The Strategy for Research Infrastructures in Portugal (see 2.2 above);
- The Evaluation and Financing of R&D Organisations (see 2.2 above);
- The Revision of SIFIDE II - the system of tax incentives for R&D expenditures. This system was subject to a revision and extension up until 2020. Whilst the system remains mainly focussed on promoting R&D activities by SMEs, there is no longer a negative discrimination against large firms;
- A Digital Portugal Agenda, aimed at fostering the development and adoption of the digital economy by citizens, business enterprises and the State, with a view to designing competitive technological products, services and solutions, which are all geared towards international markets;
- A Programme for Knowledge and Technology Transfer to Companies, encompassing seven main initiatives: (1) the setting up of the ANI (National Innovation Agency); (2) the promotion of Doctoral Programmes, carried out by a consortia of universities and companies; (3) the continuation of the programme of Doctoral grants by companies; (4) the coordination of international partnerships (with American Universities), with a focus on entrepreneurship and innovation; (5) the management of the Portuguese Office for Horizon 2020; (6) the launching of the 'FCT Seed' projects, aimed to promote the commercialisation of scientific discoveries by FCT grant

holders, and; (7) the programme for the promotion of entrepreneurship in R&I units and Higher Education establishments;

- The continuation of the 'FCT Researcher' grant programme (this time the task of evaluation will not be carried out by FCT, as previously occurred, as it has been assigned to the European Research Council).

The summary provided above shows that the 2014 NRP does not envisage major policy changes vis-à-vis the 2013 NRP with regards to the objective of strengthening R&D&I. It should be remarked that almost all the "emblematic initiatives" concern FCT and those organisations in which it has an equity stake (including ANI - the National Innovation Agency). There is a consensus that the proposed increase in R&D expenditure depends to a large extent on firms promoting R&D expenditures, and that this in turn requires changes to the prevailing profile of the economic fabric (Mamede, Godinho & Simões, 2014; Mamede, 2014; European Commission, 2014c). It is therefore surprising that no initiatives from the Ministry for the Economy are contemplated.

The Commission Staff Working Document on the assessment of the 2014 NRP and stability programme for Portugal (European Commission, 2014c) provides an interesting perspective about Portugal's R&I policy. The document acknowledges the fact "the structure of the economy, with a high share of low and medium tech production, results in a low contribution of medium/high-tech goods to the trade balance and a low share of employment in knowledge intensive activities" (European Commission, 2014c: 31), and therefore in a low level of business enterprises R&D expenditures. The document welcomes most of the "emblematic initiatives" mentioned in the 2014 NRP. It recommends, however, that "it is essential to set clear priorities, which take into account the existing research strengths and the potential for the development of competitive economic activities". This is very much in line with the initiative to develop a R&I strategy for Smart Specialisation.

2.4 Policy developments related to Council Country Specific Recommendations

On 2.6.2014 the EU Council adopted a set of Country Specific Recommendations (CSR) regarding Portugal's 2014 NRP (European Council, 2014). The recommendations regarding Research and Innovation Policy are, however, limited. More specifically, it recommended Portugal to "enhance cooperation between public research and business and foster knowledge transfer" (European Council, 2014: 8). However, this issue has already been addressed by the Portuguese Government in the design of the 2014 NRP, as well as through the strategic reorientation of the ANI and the design of the CIOP. There is clearly a need to promote University-Industry cooperation (Laranja, 2012; Mamede, 2012 e 2014; Simões, 2012; FCT, 2014). However, this requires a holistic approach, encompassing different perspectives, as knowledge sharing involves an active learning attitude and adaptation and not just the transfer of a ready-made solution (Szulanski, 2003; IESE/Quaternaire, 2014). To develop an effective policy for this matter it is essential to address the issue from the company's standpoint.

2.5 Funding trends

2.5.1 Funding flows

The National Reform Programme Portugal 2020 (link accessed on 24 February 2015), which was approved by the Council of Ministers on the 20th March, 2011, set a R&D/GDP ratio target of between 2.7%-3.3% for 2020, with the public sector contributing 1.0%-1.2%, and the private sector 1.7%-2.1%. In the current climate, which has already been highlighted in the previous sections, these figures seem too ambitious. Portuguese GERD (Gross Expenditure in Research and Development) was €2,469m in 2012, which was the equivalent to 1.4% of GDP. This represents a decline in relation to 2009, 2010 and 2011, when GERD was respectively € 2,772 m, € 2,758 m and € 2,566 m, even though it is still significantly above the years before 2009 (€1,973m in 2007, and €1,201m in 2005, with GERD/GDP ratios of 1.1% and 0.8% respectively).

As the data in the preceding paragraph indicate, the Portuguese R&D situation changed rapidly in the second half of the 2000-2009 decade, with the GERD/GDP ratio peaking at a historic high of 1.6% in 2009. A co-evolution of private and public funding had contributed to rising R&D expenditure up until 2009, bringing the country closer to the EU's average of 2.0%. Portugal reached a R&D /GDP ratio above 1% for the first time ever in 2007, which increased to 1.6% in 2009. Since then, however, this ratio has been declining, first to 1.53% in 2010, then to 1.46% in 2011, and more recently to 1.37% in 2012.

From 2007 onwards, the business sector became the most important player in the R&D system, with a share of 50% in the national GERD in 2012. In 2001, when R&D expenditure was still at 0.76% of GDP, the private sector's share of R&D funding was 32%, with the public sector still being the main contributor, with a 61% share.

Despite the non-availability of systematic data about the contribution of foreign-owned firms to BERD, there is a perception that the contribution of such firms may not be as high as in other EU member countries. According to available data about the largest R&D performers in Portugal in 2011, four majority-owned foreign subsidiaries (Nokia Siemens Networks, Volkswagen, Barclays Bank and Bosch) were among the 20 top R&D performers, accounting for around 15% of the R&D expenditures of these top 20.

At €1,626m in 2014, government budget appropriations or outlays for R&D were 8% below those of 2010, when they reached a historical high of €1,767m.

A breakdown of the 2012 R&D funding indicates that the business sector and the public sectors are by far the major funders, with shares of 46% and 43% respectively. The remaining sectors ("Higher Education", "Abroad" and the "Private non-profit" sectors) all have much smaller shares (4%, 5% and 2% of total funding respectively). The analysis of the funds provided by each sector to the remaining sectors shows a relatively low density in the research system, as the relative amounts involved in funding third-parties are typically small. The only exception to this pattern is the Government sector, which is one of the primary funding sources, which was responsible for providing a significant amount of resources to all types of research institutions in 2012 - the main beneficiary being the higher education sector (70% of government funds), followed by public research organisations (10%) and the private non-profit sector (12%). With regards to funding from the business sector, the vast majority of funds (91%) was dedicated to intramural research, which reveals a weak link with the external research sector. In relation to funds from abroad, all the four performing sectors are funded from abroad. The proportion of

direct international funding has been low (between 6% and 5% in 2011 and 2012, respectively).[4]

Over recent decades, structural funds have had an instrumental role in the development of the Portuguese R&I system. On average, the 2007-2013 NSRF Operational Programmes (OPs) dedicated €354m yearly to the national R&D budget (GBAORD) during the period of 2007-2013. This represents 20.5% of the national R&D budget over this period It must be pointed out that the annual fluctuation that has been noticed in this contribution depends more on the cycle of NSRF implementation, and that it does not necessarily reflect a trend for structural funds for R&D in Portugal, as these funds are earmarked within each programming period. In fact, a sharp rise in structural funds were noted, when one compares the programming period of 2007-2013 with the preceding one of 2000-2006, increasing from €136m in 2000-2006 to the already mentioned €354m in 2007-2013. An important aspect is that structural funds have been relevant for the development of the national R&I system not only for their direct contribution to R&D expenditure, but also more for the development of advanced human resources, as the ESF has been contributing to the training of young scientists and other related activities. As for the period that we have previously mentioned (2009-2013), an analysis of the FCT costs account indicates that the ESF funding of its FCT activities has been on average €65m per year, whereas ERDF funding has been €43m per year.

Further to the contribution of direct structural funds, EU funding has also been provided by the FP programmes. Whereas in FP6, a total of 851 projects, involving 1,202 Portuguese partners received a total contribution of €266m, in FP7, a total of 1,692 projects involving 2,222 Portuguese partners received a contribution of €526m.

[4] The resources under the classification "abroad" do not include EU structural funds for research which are channeled through the public budget.

Table 1: Basic indicators for R&D investments

	2009	2010	2011	2012	2013	2014	EU28 (2014)**
GDP growth rate (European Economic Forecast, Autumn 2014)	-2.9	1.9	-1.8	-3.3	-1.4	0.9	1.3
GERD (% of GDP)	1.58	1.53	1.46	1.37	1.36 (p)		2.07 (2012)
GERD (Euros per capita)	262.9	260.8	242.7	220.1	221.4 (p)		530.1 (2012)
GBAORD - Total R&D appropriations (€ million)	1,753	1,768	1,754	1,555	1,579	1,626 (p)	90,505.611
R&D funded by Business Enterprise Sector (% of GDP)	0.75	0.70	0.69	0.68	0.65 (p)		1.12% (2011)
R&D funded by Private non-profit (% of GDP)	0.14	0.15	0.13	0.12	0,12 (p)		0.03%e(2011)
R&D funded from abroad (% of GDP)	0.06	0.05	0.09	0.07	na		0.19% (2011)
R&D related FDI	na	na	na	na	na		
R&D performed by HEIs (% of GERD)	37 %	37%	36 %	36%	38% (p)		23.6.% (2012)
R&D performed by Government Sector (% of GERD)	7%	7%	7%	5 %	6% (p)		12.2% (2012)
R&D performed by Business Enterprise Sector (% of GERD)	47%	46%	47%	500%	48% (p)		63.3% (2012)
Share of project vs. institutional public funding for R&D #1 (w)	57.1	46.4	47.6	48.8	48.0		na
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	3.0	2.9	2.9	2.9	2.8		5.6% (2011)
Employment in knowledge-intensive service sectors as share of total employment	29.3	30.0	31.6	32.5	na		38.9% (2011)
Turnover from Innovation as % of total turnover	na	14.4	na	na	na		13.4% (EU-27, 2010)

Sources: EUROSTAT, except for #1, which is DGEEC/MEC and for #2, which is GPPQ.

Notes: p – provisional; e – estimate; na – not available; (w) weight of FCT, UMIC and the NSRF's OPs in the total public budget for R&D (GBAORD); (SF) the amount on "R&D funded by the Structural funds", which refers to the addition of the contributions of the NSRF operational programmes to the national GBAORD, which involves the contribution of structural funds proper, plus the national contribution to these operational programmes.

2.5.2 Project vs. institutional allocation of public funding

The main entities that have governed competitive research funding in Portugal have been FCT (the Foundation for S&T), AdI (the Innovation Agency) and IAPMEI (the Institute for Competitiveness and Innovation), the former concentrates more on academic research funding, and the latter two on industrially-oriented research funding. A significant part of the financial resources for research of these three entities stems from the Operational Programmes, which are co-funded by national and cohesion funds, although important allocations also stem exclusively from national funding.

Further to competitive research funding, institutional block funding exists, which consists of direct allocations to institutions from the annual national budget. This type of funding has been mainly directed to the national public laboratories. Further to this, there is the funding of research at universities and other higher education institutions, but this has been calculated as a fixed percentage of the salaries paid to the teaching staff of those institutions.

Over the recent years, important changes have been made to the regulatory framework for the allocation of R&D funds. FCT has defined a new arrangement for the funding of those research units that belong to the national scientific system. A second source of change in the regulatory framework concerns the regulations for those measures that will be implemented within the new Operational Programmes. These regulations are now in the pipeline of publication and most will become public during the forthcoming months. These potential changes may have implications, mainly in relation to the allocation of competitive funds for innovation-driven research.

Institutional funding

Traditionally, the main type of institutional funding used to be the block funding allocated to the national public labs. All of the existing public labs have a sectorial nature, and typically each of them depends on a different ministry. This segment of the R&I system has however lost its relative importance over the decades. This long-term process has continued more recently, as the funds allocated under this item have declined from €176m in 2011, to €154m in 2013, and to €125m in 2014. The funding of these entities does not depend on efficiency or effectiveness criteria, but it is rather based on tradition and the number of tenured personnel in each lab.

In 1994, a new scheme was initiated to provide institutional funding for research units operating within universities and other academic institutions. As pointed out above, FCT has recently changed this scheme with a new funding arrangement. The former funding arrangement implied a two-tiered system of 'research units', and 'associate labs'. In 2010 a total of 308 research units with a total of 9,558 researchers received €35m (€3,652 per researcher), whilst the 25 existing associate labs had 2,058 researchers, and received €44m (€21,137 per researcher). For that year (2010) the total FCT funding for research units was €85m.

The new funding arrangement, which will be effective from 2015 onwards, will produce a multi-tiered system. A total of 322 R&D units were involved in the evaluation exercise, which was carried out in two different stages. In the sequence of the first stage, it was announced that 55% would proceed to the second stage. Of the 45% retained in the first stage, 31% received a classification of 'Good' or below. These units are expected to receive

less than €1k per researcher, per year, or no funds at all. The remaining 14% are expected to receive further funding for restructuring, which will incrementally raise the average funding per researcher above the previous 31%. The remaining 55% of the 322 research units under evaluation, which integrate 10,992 researchers, making up 62% of the researchers in all the evaluated units, were selected for the second stage of evaluation. As indicated in point 2.3 above, the results of the second stage of the evaluation process were disclosed by FCT in December 2014 (link accessed on 24 February 2015), with 11 units ranked as 'Outstanding', 52 as 'Excellent' and 104 as 'Very Good', while a few of those in the second stage were still ranked below those qualitative levels. The funding to be assigned to the research units evaluated in the second stage is about €70m per year. The funding per researcher rises exponentially for the units in the two top levels, with those in the 'Outstanding' bracket expected to receive €13m per year. The implication of this exponential rise, is that most of the research units will now receive much less funding than before, posing a severe strain on their survival.

For this recent evaluation, FCT requested the services of international evaluators who were recruited by the ESF. Although the process was meant to be transparent, and in accordance with best practice standards, it has not been implemented without problems, and criticisms have been made in the press and also through public declarations made by prominent scientists (an account of this situation is made in section 2.2 above). It is believed this will continue to be a topic of discussion throughout 2015.

Project funding

FCT regularly publishes calls for the funding of scientific research projects. This happens both through calls open to all scientific areas, which normally open annually, or through calls targeting specific themes or domains. Both AdI and IAPMEI also regularly publish calls, as part of their roles as co-managers of the Operational Programmes, for funding industrially-oriented, innovation-driven research projects.

Looking at the costs account of the FCT, we notice that the item 'R&D projects' has risen respectively from €65m to €105m between 2011 and 2013. The funding of these projects clearly has a competitive nature.

Projects are evaluated in accordance with the principles of independent refereeing, and funding is provided according to the perceived scientific merit. Whilst up until the 1990s only national experts used to take part in these evaluation panels, this situation has changed very significantly over the last two decades. For those scientific research projects funded by FCT, several criteria are taken into account, the two main ones being (FCT site, accessed on 25 February 2015): "a) the scientific merit and innovative character of the project and b) the scientific merit of the research team". Based on these criteria, the evaluation and selection panels rank the project applications in accordance with international best-practices and project funding is thus allocated on the basis of international peer-review standards.

With respect to those innovation-driven R&D projects which have been funded under the measures of the Operational Programmes, and for which typically the main contenders are firms (although in some cases applications are submitted by consortia which also integrate university labs), both the evaluation criteria and the membership of the panels differ from those organised by FCT. This funding has declined from €401m in 2011, to €361m in 2013.

Assessment

There is some difficulty in drawing conclusions in relation to the trends of institutional and project funding, as some of the data available is provided as budget figures, and other as actual costs. Looking at the cost account of FCT, the indication is that (academic) project funding has been rising, with funding growing from €65m to €105m. Furthermore, the institutional funding by FCT of academic research entities, which is based on regular evaluation, has also been grown from €47m to €69m over the same period (2011 to 2013). However, the trend in these two types of expenditure is contradictory to the budget information for the relevant measures of the NSRF OPs, which indicates a reduction from €401m to €361m. When the figures are observed over a longer time-span, it is also clear that the current funding has not yet matched the pre-crisis funding (in 2010, FCT funding for the research units was €85m).

What seems to be clear however, is that institutional block funding has been declining, which means that total competitive funding (project-based funding and also institutional funding dependent on performance evaluation) has been on the rise. Block funding has declined as both national public labs grants and the budget allocations estimated for the higher education sector have experimented a significant reduction, from €890m to €788m, although this decline is mainly related to wages restrictions imposed on the personnel of these institutions in recent years.

As far as the Portuguese R&I system is concerned, the problem does not seem to be essentially one of striking a better balance between project and institutional funding, but rather whether the allocation of each of these types of funding is being carried out in the most effective and efficient way. Right now, with regards to competitive funding granted to those research units that are funded by FCT, the debate is about whether those that perform better (and sometimes only incrementally better) should be proportionally granted much greater funding. It seems sensible that the trade-off between the stimulus to the excellence and sustainability of the research system will not occur in a country like Portugal by adopting the same criteria as more mature and stable systems, although it seems clear that there is a need to renovate certain segments of the research system.

A significant proportion of FCT funds are still allocated to 'international collaboration'. Agreements with several US universities and fees for participation in international research labs fall under into this category. In 2013, this item accounted for €37m. Most of this expenditure was not evaluated, and therefore no clear idea exists as to what is its relative pay-back in comparison to other items of the FCT account.

2.5.3 R&I funding

In the sequence of the main evaluations that were carried out in relation to the R&D and innovation support measures of the former NSRF, the perception that now exists is that the policy toolbox used to stimulate research and innovation is relatively comprehensive in Portugal (Mamede, Godinho & Simões, 2014). Over the years, Portugal has introduced those main types of policy initiatives that had been successfully tested in this field by other EU members. It is thus not surprising that Portugal has moved along the same lines as other countries, providing public funding for research and innovation, both through direct, and indirect policy instruments.

The tools addressing academic research are essentially of a direct nature and they have been mainly managed by FCT, as reviewed above in this report.

In recent years, direct incentives to innovation have been mainly managed by COMPETE, the Competitiveness Factors OP of the National Strategic Reference Framework, 2007-2013. The two main incentive systems for innovation under COMPETE were those of SII&DT and SIInovação (respectively the Incentives System for R&D in Business Firms and the Incentives System for Innovation). At the same time, COMPETE implemented the so-called Collective Efficiency Strategies, which are horizontal actions with an "innovation dimension". The main action under the Collective Efficiency Strategies was the setting up of Competitiveness and Technology Poles (CTP), focussed on the promotion of clustering initiatives to strengthen the linkages among key players in the national and regional innovation systems.

Indirect incentives have been promoted under SIFIDE. This is a tax credit system for stimulating R&D in businesses, which allows for deductions off IRC (the business revenue tax). The following are eligible for being deducted off IRC: the equity of research and development entities; the costs of filing for patents and their maintenance fees; the costs of R&D audits; investments in the purchasing of R&D equipment, and; the salaries of researchers and auxiliary personnel involved with research and development.

The Budget Law for 2011 extended the system up to 2015 (SIFIDE II), and improved the conditions granted to R&D performing companies. SIFIDE includes two kinds of incentives for companies performing R&D: a basic tax incentive, which corresponds to 32.5% of all eligible R&D expenditure made in the relevant fiscal year, and an incremental incentive, which corresponds to 50% of the increase in R&D expenditure when compared to the average of the two previous years. The amount of tax credits approved under SIFIDE has been close to €100m per year. This system was reviewed in 2013 in order to positively discriminate those projects that involve cooperation with other entities and international cooperation, and has open access to the results. The_Budget Law for 2014 (Lei nº 83-C/2013, December the 31st) (link accessed on 24 February 2015) extended (article 211th) SIFIDE II up to 2020.

Another type of tax incentives for R&D is the regime of scientific patronage. This regime, which was enacted by Law 26/2004, provides tax incentives to both individuals and organisations that contribute to the financing of the activities of foundations, institutes, associations, higher education institutions, and other units or centres that carrying out R&D activities. In 2012, there 1,928 such entities participated in this system and the total deductions on their taxable income amounted to €21m.

The main managing agency of the CFOP programmes mentioned above has been IAPMEI (Agency for Competitiveness and Innovation), however the former AdI (Innovation Agency, now ANI) has been in charge of the 'R&D in consortium' measure. AdI has furthermore been in charge of SIFIDE.

Most R&I funding is neither thematically nor sectorally focused. The dominant approach has been characterised by generic incentive systems, which do not address specific industries, technologies or scientific fields. A notable exception to this are the collective efficiency strategies (particularly CTPs and Other Clusters), where the clustering theme is key. From what is known so far, under the new programming period of 2014-2020, OPs bring a change of perspective regarding these matters, with the definition of some priorities in connection to the RIS3 perspective.

2.6 Smart Specialisation (RIS3)

The development of Smart Specialisation (RIS3) initiatives has been undertaken at both regional and national levels. Several regions have invested a significant amount of effort in this regard since an early stage, as reported by Cooke & Simões (2013). At the national level, FCT took the lead by undertaking a SWOT analysis, which provided a thorough assessment of the Portuguese research system. There was "a wide consensus [...] about the relevance of 'transversality', exploring the opportunities for related variety as well as for entrepreneurial discovery" (Cooke & Simões, 2013: 3).

In the wake of the FCT SWOT exercise, a working group on Smart Specialisation was established, which included the main national organisations involved with R&I policies (FCT, IAPMEI and AdI and COMPETE). An exercise of stakeholder consultation was carried out, involving academia and firms at an equal level, including the management of Competitiveness and Technology Poles and the Regional Coordination Commissions. This led to the definition of a 'Research and Innovation Strategy for Smart Specialisation' (Governo de Portugal, 2014d). This document includes three parts. The first part provides the details of the Smart Specialisation strategy at the national level. The second addresses those of the regional level, dividing the approaches into the five regions of Mainland Portugal (Norte, Centro, Lisboa, Alentejo and Algarve), as well as the Autonomous Regions of Madeira and Azores islands. The third relates to the multi-level elements of the Smart Specialisation strategy, namely: policy mix; the matrix of the territorial dimensions of thematic priorities; the governance model; and monitoring and evaluation instruments. The strategy was officially approved by the Joint Decision of the Secretaries of State of Regional Development, Innovation, Investment and Competitiveness and of Science, on the 23rd December, 2014 (Governo de Portugal, 2014e).

This strategy defines a set of thematic R&I priorities, combining both the national and regional levels, by means of a matrix of the territorial dimensions of thematic priorities. This is depicted on Exhibit 1 below.

At the national level, there are five main "thematic axes":

1. Cross-cutting Technologies & Applications: encompassing Energy, ICTs and Materials & Raw-Materials;
2. Manufacturing Industry & Technologies: which includes two main priority themes: Manufacturing Technologies & Product Industries, and Manufacturing Technologies & Process Industries;
3. Mobility, Space & Logistics, with two themes: Automotive, Aeronautics & Space; Transport, Mobility & Logistics;
4. Natural Resources and the Environment, which covers the following priorities: Agribusiness; Forestry; The Maritime Economy; and Water & the Environment;
5. Health, Well-Being and Territory, encompassing four themes: Health; Tourism; Cultural and Creative Industries, and; Habitat.

Regional strategies are anchored on these "thematic axes", but they express them in different ways and with different focus areas. For instance, the Norte region, takes onboard all the fields considered at national level and assigns them different priorities, putting the focus on: ICTs; Manufacturing Technologies & Product Industries; Automotive, Aeronautics & Space Industries; Health, and; Cultural and Creative Industries. In contrast,

the strategy for the Algarve does not include all the axes defined at the national level, focusing instead on the Maritime Economy and Tourism. The whole set of regional thematic priorities is provided on Figure 2.

Figure 2: Global thematic priorities matrix

Thematic Axes	Priority Themes	Nacional	Norte	Centro	Lisboa	Alentejo	Algarve	R. A. Madeira	R. A. Açores
I. Cross-cutting technologies and their applications	1. Energy								
	2. Information and Communications								
	3. Materials and Raw-Materials								
II. Industry and Production Technologies	4. Production Technologies and Product Industries								
	5. Production Technologies and Process Industries								
III. Mobility, Space and Logistics	6. Automobile, Aeronautics and Space								
	7. Transport, Mobility and Logistics								
IV. Natural Resources and Environment	8. Agro-food								
	9. Forest								
	10. Sea Economy								
	11. Water and environment								
V. Health, Well Being and Territory	12. Health								
	13. Tourism								
	14. Cultural and Creative Industries								
	15. Habitat								
		more important		4	3	2	1	less important	

The document of the 'Research and Innovation Strategy for Smart Specialisation' does not provide a detailed account of the financial commitments required, including those for structural co-funding. This is provided instead in the Partnership Agreement, which is agreed with the European Commission, of which the strategy for Smart Specialisation is one of the items covered. In other words, the Partnership Agreement establishes the financial wrapper, including European and national funding, that is required to implement the Smart Specialisation strategy. In the context of the Operationional Programmes included in the Parnership Agreement, measures are included which are aimed at stimulating private investments, namely in the fields of R&D and innovation.

As mentioned above, the 'Research and Innovation Strategy for Smart Specialisation' provides a multi-level governance model, combining both the national and regional levels. This is "based on the cooperation and the sharing [of resources] among the multiple players which take place in the collective and systemic process of carrying out R&D and innovation activities" (Governo de Portugal, 2014d: 167). The governance model encompasses the following levels: (1) The political coordination of the policy mix, which is assigned to an Inter-ministerial Commission involving those Ministries more directly related to competitiveness and internationalisation, as well as to regional policy; (2) Strategic advice, through a consultative body composed of representatives of the main stakeholders in the R&I system; (3) Evaluation, assigned to an international strategic evaluation

committee, and; (4) Executive functions, to be carried out by a Technical Secretariat, which is in charge of the follow-up of the policy mix, the implementation of the measures stemming from the recommendations of the bodies mentioned in (1) and (2), and of ensuring the information flow among all the players in the system.

The monitoring system is closely related to the process of monitoring the implementation of the Competitiveness and Internationalisation OP. The results of this process will be reflected in a monitoring report, which is to be published on a yearly basis. Furthermore, internal monitoring procedures are also foreseen, to follow up on the implementation of the strategy. Evaluation activities will be carried out by the international strategic evaluation committee already mentioned under (3) above. The committee will include international experts from the science and business fields. Evaluation activities will be focussed on three main issues: strategy, operationalisation, and capability-building.

2.7 Evaluations, consultations, foresight exercises

Two sets of programme evaluations took place in 2013 and 2014. In 2013, the evaluations of the key programmes dealing with R&I took place, the most relevant being the evaluations of the Competitiveness Factors Operational Programme- CFOP ('Compete') and the evaluation of the Strategic Evaluation of the NSRF 2007-2013 in the fields of Innovation and Internationalisation (IESE/Quaternaire Portugal, 2013). In 2014, a round of *ex-ante* evaluations of the Portugal 2020 Partnership Agreement occurred, as well as of the thematic and regional Operational Programmes that fall under the Portugal 2020 Agreement. However, with the exception of the Portugal 2020 Partnership Agreement, the results of such *ex-ante* evaluations had not been disclosed at the time of writing (January 2015), except for those concerning the environmental evaluations of the OPs of Competitiveness and Internationalisation, and Resource Sustainability and Efficiency.

The evaluation of the CFOP/'COMPETE' (Augusto Mateus & Associados/ PriceWaterhouseCoopers, 2013) provides interesting conclusions, including the following:

- COMPETE's performance is assessed as being positive, whilst recognising that the effects have a long maturation time;
- Those firms supported by COMPETE are, in general, better than the benchmark of Portuguese firms, exhibiting motivations and strategies focussed on the key competitive challenges;
- The potential results of supported projects are generally positive, but there are qualitative gaps, namely regarding research personnel and export orientation, that need to be addressed;
- Supported projects had a very positive impact on firms' performance;
- COMPETE had a positive effect on the promotion of exports, and;
- The contribution toward the development of a knowledge-based economy has clearly been positive, namely with regards to the collaboration between firms and research organisations, but this has not reached a level that could catalyse a significant structural change.

The strategic evaluation of the effects of the 2007-2013 NSRF on innovation and internationalisation is largely convergent with the above conclusions, and broadly confirms

the appropriateness of the policy adopted for that purpose (Quaternaire Portugal/ IESE, 2013). Innovation and internationalization were found to be closely related, with positive reciprocal interactions. The incentive system was considered to have a wide scope, having reached a high level of maturity and it was positively assessed by stakeholders. This led to a recommendation that the 2014-2020 CIOP should focus more on incremental improvements to the existing set of instrument, rather than on a 'revolutionary' redesign of innovation policy instruments. The following aspects were highlighted: combatting the 'atomisation' of technology-based incubators; adjusting the financing of technology-based projects' pre-incubation and incubation to the needs of the promoters; fostering project demonstration initiatives; improving and streamlining evaluation processes; increasing inter-regional consistency, and; launching experimentation initiatives in specific fields.

Another policy area of the 2014-2020 NSRF subject to a specific evaluation concerns the 'Financial Instruments'. However this evaluation had already been launched in 2014, although it has not been completed at the time of writing.

The ex-ante evaluation of the Portugal 2020 Partnership Agreement (Iceta, 2013) was generic, and did not specifically focus on R&I issues. Therefore, we will not provide a general summary, but rather will highlight those findings and recommendations that touch upon R&I policy. Broadly speaking, the evaluation considered that the distribution of European Structural Funds by the different thematic objectives is adequate, thus reflecting the diagnosis undertaken. The overall ex-ante evaluation of CIOP is positive and it was found to provide "strong guarantees of effectiveness in terms of expected results and impacts with regard to the alleviation of the chronic weaknesses of the Portuguese productive system" (Iceta, 2013: 40). It is recommended that a broader opportunity for large scale R&D projects should be provided, and the launching of thematic tenders for projects between Portuguese R&D organisations and "knowledge centres referenced worldwide". Another recommendation concerns an increased focus on exploring the opportunities for attracting FDI, in order to increase business R&D and structural change. A cautionary note is made about the shortcomings of an excessive focus on incentives of a repayable nature. It is also recommended that incentives regarding financial engineering instruments should be nationwide, and that they should not be regionally focussed. The relationship between existing Competitiveness and Technology Poles and the thematic areas of Smart Specialisation should also be taken into account in the definition of policy measures.

The main consultation process regarding R&I policy in Portugal took place in the context of the design of a R&I policy for Smart Specialisation. As was explained in 2.6 above, this involved the collaboration of several national and regional public organisations, and also interaction with multiple stakeholders including inter alia firms, business associations, universities, and R&D centres.

Whilst there has been no formal foresight exercise undertaken during the period concerned, it should be recognised that the process of designing the R&I strategy for Smart Specialisation took into consideration the prospects for future scientific and technological developments.

3. National progress towards realisation of ERA

3.1 ERA priority 2: Optimal transnational co-operation and competition

Internationalisation has been one of the key objectives of Portugal's scientific and technological (S&T) policy over the most recent decades. This has been translated into several actions, all aimed at strengthening Portugal's involvement in the successive Framework Programmes (FPs), as well as in the building of the European Research Area. To enhance Portuguese involvement in FP7, a National Office for Promoting Portuguese Participation in the Framework Programme (GPPQ) was established in 2007. GPPQ has meanwhile been integrated into FCT, and is now active in diffusing information and in promoting participation in H2020. In FP7, the Portuguese contribution to the overall budget was 1.04%, whilst the national teams benefitted from 1.02% of the overall FP7 funding. The return is higher than that obtained in FP6. Despite the recent improvements, Portugal still needs to improve its capability to collect the spillovers from an increased participation in international research efforts, and should integrate them into the strengthening of national research institutions and strategic projects. Specifically, national policies need to learn to manage the trade-off between increasing European collaboration and the capturing of benefits for Portugal, as spatial economies of scale are set within ERA. Such a need is particularly acute nowadays, as an increased involvement in Horizon 2020 is envisaged as being critical, to compensate for the decline of domestic budgetary allocations for research.

The involvement in the ERA-NETs provides a very interesting example of Portugal's transnational cooperation. FCT has participated in 61 ERA-NETs (31 ongoing) (link accessed on 24 February 2015), promoting cooperation with other scientific research funding agencies, ministries and research institutes of EU Member States, as well those of associated and third countries. This area was considered by GPPQ as being one of those in which Portuguese participation has been more successful (GPPQ, Newsletters of May and November 2010). Criteria for making the decision to participate in ERA-NETs have been related to both the research excellence of the Portuguese ERA-NET 'champions', and also the existence of a critical research mass in Portugal (Godinho & Simões, 2011). In parallel to the establishment and running of ERA-NETs, FCT has also been active in promoting participation in several INCO-Nets, where the scope of coordination with third countries is more significant.

Examples of two relevant initiatives taken in recent years regarding this priority include the setting up of the International Nanotechnology Laboratory (INL) and the development of the National Roadmap for Research Infrastructures, which is aligned with the ESFRI Roadmap.

The first initiative dates back to 2005. Established as a joint-venture between the Portuguese and the Spanish governments, the INL was the first fully international research organisation to be created in Europe in the field of nanoscience and nanotechnology. It aimed to become a world reference in these fields. Unfortunately, however, the INL has not been immune to the effects of the budgetary cuts on both the Portuguese and the Spanish sides. This has to some extent undermined the Institute's development and its international affirmation. In September, 2014, a new director, who is a former pro-rector at Lund University, was appointed for a period of 5 years.

Secondly, the design of the National Roadmap for Research Infrastructures took place between 2012 and 2013. FCT launched a public consultation of the Portuguese scientific community, enabling the collection of updated information on existing interest and the potential of participation in ESFRI Roadmap Research Infrastructures. In the second semester of 2012, those Portuguese research infrastructures that matched the concept put forward by the ESF were identified. In the second semester of 2013, a call for proposals was launched, to establish a national roadmap of research infrastructures of strategic relevance, which was open until the 30th of September (see section 2.2 above for more details about this call).

While internationalisation has been a priority of national research policies, such orientation was essentially focused on either supporting the involvement of Portuguese researchers in international networks and partnerships, or their involvement in international research fora and infrastructures (such as ESA, CERN, EMBO etc.). A more active attitude towards increasing the external coherence and international coordination of national research policies started to only occur more recently, through the supporting of joint activities (INL is a good example), or the launching of joint calls with a certain degree of coordination of research agendas (the ERA-Nets are possible examples in this respect). These activities started in the previous decade and have been maintained in recent years, although the momentum for greater cooperation that was being created suffered a certain setback with the economic and financial crisis. The successive budgetary cuts have impaired INL's development and also its ability to become an international reference in its area. There is, however, now the prospect that the National Strategy for Smart Specialization will be published, which will provide a new framework for the coordination of the national research policies with pan-European policies and priorities.

3.2 ERA priority 3: An open labour market for researchers. Facilitating mobility, supporting training and ensuring attractive careers

The main challenge in this priority is that countries vary remarkably in terms of their institutions. It is necessary to address more explicitly the differences between those countries that have a highly regulated market for researchers, and those characterised by high institutional autonomy in staffing decisions (see ERA-Synthesis Report 2013)[5].

3.2.1 Introduction

The conditions in the research labour market in Portugal changed significantly over the most recent decades. In 1982, there were 3,963 FTE Researchers, and by 2003, the equivalent figure was 20,242. The latest figures indicate that the research system kept expanding until the early 2010s, as 42,498 FTE Researchers were accounted for in 2012. Whilst until the 1990s, most of these researchers were employed in the public sector (2,095 in 1990) and in the university sector (3,938 in 1990) with tenured positions, the situation has changed remarkably over the last two decades (1,615 and 23,849

5 http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/30386/1/ipts_erasynthesisreport_final.pdf

respectively in 2013 - both being provisional figures). Firstly, business sector R&D activities developed significantly and thus grew their share of researchers (1,001 in 1990, and 12,539 for 2013 - again provisional figures). Secondly, with the growing supply of PhDs and the creation of a diversity of post-doc positions, the proportion of non-tenured positions in academic institutions also rose significantly.

With the exception of the private business sector and, to a certain extent, that of the private non-profit research sector, research careers have been highly regulated. Those careers that provide access to tenured jobs, in public higher education institutions and in public labs, are regulated by dedicated statutes (see the next point),and as most post-doctoral positions are funded by FCT, these research jobs also depend on regulations provided by FCT. The trend for a greater autonomy of institutions to be able to contract, which started to emerge a decade ago, has meanwhile been reversed, as the financial rules for public contracting have been tightened up, as a consequence of the budgetary difficulties the country has been facing in the most recent years.

3.2.2 Open, transparent and merit-based recruitment of researchers

In general terms, the legal framework regulating the access to research positions in Portugal, and the practices associated with its implementation, guarantee open, transparent and merit based recruitment. Over the last decade, many institutions implemented more difficult tenure-granting procedures, whilst the recruitment of new researchers become more difficult, on account of budgetary or legal restrictions.

The framework for contracting researchers into research careers in academic institutions is provided by: (a) The Law of Work Contracts in Public Functions (civil service), which regulates all labour contracts of civil servants, or the equivalent, such as university teachers who work for public universities or researchers with permanent careers in public labs; (b) The Statute of the Scientific Research Career (Estatuto da Carreira de Investigação, Decreto-Lei nº 125/99, published on 20 April 1999), which regulates the careers of researchers with permanent careers in public labs; (c) ECDU, the Statute of the University Teaching Career (Estatuto da Carreira Docente Universitária, Decreto-Lei n.º 205/2009, published on the 31st of August, 2009), which regulates the careers of university teachers who have permanent careers at universities, and; (d) The FCT Investigator (regulation of the Researcher of the Science and Technology Foundation, Decreto-Lei nº 28/2013, published on 19 February 2013, link accessed on 24 February 2015), which is a "softer" regulation (as it is not a "Law") which regulates the contracts and work of those working as researchers during temporary periods (up to 5 years).

Recruiting procedures are quite standardised, as the existing legal framework imposes certain steps for the recruiting process. Vacancies for permanent positions (both tenured and other similar positions) at the university all have to be advertised. However, a proportion of those contracted have the statute of "invited (or visiting) lecturers". In some faculties these can comprise as much as 50% of the total academic staff. For these posts, vacancies do not have to be advertised, although those selected through this mechanism are normally "invited" for junior positions, and do not hold administrative or strategic responsibilities within the institution.

The process for recruiting for tenured positions is basically transparent, although, until recently, a significant part of the vacancies were not available in any other language

except Portuguese. This situation has however been changing. The ECDU (Statute of the University Teaching Career), which was originally published in 1979, permits more flexibility in terms of contracting researchers for working abroad, after its 2009 review. According to the ECDU's Article 37, competitions for the recruitment of full professors, associate professors and assistant professors should all be open to foreigners. Advertisements for these positions have to include a description of the job profile and the skills and competences required, and also eligibility criteria. Information on the selection process and criteria is available for candidates, and a minimum time period between the advertisement of the vacancy and the deadline for applications has to be defined. Applicants have both the right to receive feedback about the results of the recruitment process and have the right to appeal against the decision. The composition of the selection panel is published, and this needs to include members external to the institution.

Traditionally, those working for both public universities and national research labs had well established careers, all holding permanent positions, or at least having access to them. Over recent decades however, both institutions have been able to contract researchers with funding for short periods of time, ranging from a few months, up to 5 years. Moreover, since 2008, some universities (4 out of 18) switched to a Foundation statute, and new contracts celebrated by this sub-group of universities are regulated by private law, rather than by public law.

Universities have had their personnel budgets capped during the most recent years, which means that they have only been able to contract for the permanent careers whenever someone leaves (for retirement, or for other reasons). As the capacity to recruit had already been curtailed, this means that most universities are now starting to face a general ageing of their staff.

The programmes implemented over the last decade, in connection with offering post-doc grants and positions for post-doc researchers with 3 or 5 year contracts (firstly CIENCIA, 2008, and then more recently, FCT Investigator) have allowed the country to attract many high quality junior researchers from other countries. In the decade between 2000 and 2009, 34% of post-doc grants were awarded to foreigners (mainly from Spain, Italy and Brazil). This practice of contracting younger foreign researchers may have a long-term impact by increasing the internationalisation of the domestic research labour market.

The FCT Investigator Programme was implemented in 2012, with the aim of investing in human capital, by ensuring that the best researchers remain in the country and also by attracting researchers from abroad. 5 year contracts are offered to post-doc researchers, with typically 3 to 6 years of experience after obtaining their PhDs. A position under this programme is attractive, as it provides professional stability and funding for a 5-year period. A pool of researchers is selected annually through international competitions. In the first call (2012), 159 researchers were selected, whilst in the second call (2013), a further 210 were selected. A total of 1,500 applications were submitted during the 2014 call, and 510 applicants were selected for a 2nd stage evaluation. On the 12th of December, 2014 it was announced that funding had been recommended for a total of 228 applications. It is expected that around 1,000 researchers will benefit from this programme by 2016.

3.2.3 Access to and portability of grants

Natural Apart the activity of some private foundations, the bulk of research grants is offered by FCT. The "Regulation for Grants awarded by FCT" (link accessed on 25 February

2015) governs the selection, hiring and legal regime applicable to all grants that are funded directly, or indirectly, by FCT. Article 14 of this regulation states that candidates applying for the grants awarded by FCT have to be: "Nationals or citizens of other member states of the European Union; Citizens of third states, holders of permanent residence or beneficiaries of the status of long-term resident; Other citizens of third states, whenever the tender opening the competition foresees the possibility of an individual interview". Further it is stated that for those grants directly funded by FCT, "foreign citizens who are not resident in Portugal may apply, provided that their application is supported by a national host institution".

In sum, no cross-border portability of grants is foreseen by this regulation, as the existing legal framework dos not favour the portability of national grants abroad.

3.2.4 EURAXESS

EURAXESS Portugal provides information and support to researchers moving to and from Portugal. Together with other national EURAXESS portals, it complements the European portal operated by the European Commission, by providing national and local information. The Portuguese services centres assist incoming researchers on matters relating to their stay in Portugal. In addition to managing the Internet portal, EURAXESS Portugal also has a coordination centre located in Lisbon, plus 8 Euraxess Services Centres located in different Portuguese regions. There are a further 4 Local Contact Points, which assist researchers coming to, or leaving their own institution.

3.2.5 Doctoral training

Portuguese universities have enjoyed certain autonomy in developing new doctoral programmes, although most of those existing coincide with the scientific areas that have traditionally characterised their departmental and faculty structures. To establish a new programme (and this applies to both undergraduate and graduate programmes), at present universities have to present a proposal in accordance with a very detailed template which is produced by A3ES, the government accreditation agency for higher education. For a new programme to be launched, such proposals are submitted for peer-review evaluation, organised by A3ES. To be able to create or maintain specific areas of doctoral programmes, universities are required to have their research units evaluated and accredited by FCT in those scientific areas.

Over the last decades, the number of PhD graduates has risen fast, with the milestone of more than 2.000 new PhD graduates being reached in 2012. All the main universities now offer PhD programmes, in which typically students have to attend advanced courses in the first year, and after that they have to write up their theses during the subsequent years. These programmes, which encompass all the main disciplinary areas, are organised in accordance with demanding scientific and pedagogic criteria, which are set by both the universities and by the existing regulations. A3ES is obliged to evaluate all new proposals for PhD programmes, and existing ones are subject to regular assessments which often lead to recommendations for significant change, the most drastic being the closure of a programme.

This increase and improvement of supply has, however, encountered some problems in recent years. An increasing number of new PhD graduates have experienced difficulty in finding jobs in the research labour market. The economic crisis has also meant that firms have not been contracting highly qualified personnel. Simultaneously, FCT has reviewed its policy of grants and financial support for doctoral training, which used to be generous in previous decades.

The "FCT PhD Programmes" were established in 2012, as part of a definition of a new typology and diversity of doctoral programmes. This policy is in line with the "Principles for Innovative Doctoral Education", whose key objectives are as follows: to support the development of internationally competitive, research-based PhD Programmes; to foster collaboration and the sharing of resources between Portuguese universities, to strengthen the international status of these universities, and; to equip students with the necessary transferable skills. Funding for "FCT PhD Programmes" covers the costs of: PhD grants (national or mixed) for three or four years' maximum; *Bolsas de Investigação Científica* (BIC grants) for a maximum duration of one year; and training courses, laboratory rotations, or other types of field work which may be necessary in order to achieve the scientific aims of a PhD programme. The funding of selected PhD programmes is limited to four years. In answer to the two calls for support that were launched in 2012 and 2013, a total of 450 applications for support were submitted, of which just 96 were approved. In parallel, 2,416 PhD grants were provided, which equates to a yearly average of 600 new grants per year from 2015 onwards. A further €6.9m complementary budget was also recommended (for courses, laboratory rotations and fieldwork).

3.2.6 HR strategy for researchers incorporating the Charter and Code

The Charter & Code has not been prominent in the policy agenda in Portugal in recent years. The number of entities that have signed the Charter & Code in Portugal remains limited. There are no known agreements through which national authorities incentivise the effective implementation of HRS4R by publicly funded institutions. Furthermore, no evaluations of this policy have been performed to date. However, this does not mean that many of the principles of the Charter & Code have not been implemented in Portugal. The research system as a whole has converged its activities, output and management modes with the best international practices over the last few decades. Through mobility, circulation and collaboration with foreign research institutions, the research system has acquired a significant international orientation.

Job vacancies tend to be published on relevant national or European online platforms, at least for senior positions, including the EURAXESS portal and the ERA Careers portal. Institutions systematically establish selection panels and advertise their composition. All public institutions in Portugal are obliged to publish vacancies in one of the existing public media, together with the selection criteria and a definition of the minimum time period between the publication of the vacancy and the deadline for the submission of applications. Applicants have the right to demand adequate feedback and they also have the right to appeal.

For a long time, the research labour market represented an interesting prospect for bright young scientists. The research labour market could at the same time provide jobs for both residents of Portugal and others coming from abroad. However this has changed over the

last few years, with many of younger researchers now contemplating the possibility of working abroad.

The capacity of the R&I system to offer prospects for a sustainable research career have been declining steadily in Portugal since at least the last decade. Few researchers from the younger generation have gained access to tenured places. For several years there was a significant rise in the offer of post-doc grants, and a number of holders of these grants were able to benefit from these grants for two successive periods of 3 years. However, the number of grants offered has declined and the capacity to offer new jobs for those who have acquired an adequate CV is limited. It has recently been announced that post-doc grants are now limited to a maximum of a 3-year period. Despite this being a positive initiative, the FCT Investigator Programme has only been able to absorb a fraction of these researchers, with prospect of a job which is limited to a period of 5 years in this case.

One area which is related to the Charter & Code principles where significant progress has been made is that of gender balance. More than half of the academic staff, which is presently working at Portuguese universities and research institutions, are female researchers. It is however known that this balance has only been achieved for junior positions, whilst the ratio of female to male researchers in senior positions remains highly biased. The expectation is that, with the natural evolution of the research system and the retirement of those in senior positions, that a balance will be achieved throughout all the levels of seniority.

In relation to the incorporation of foreign researchers in the national research system, Portugal has not yet reached a significant level of internationalisation. This is due to historical, cultural and geographic reasons, as the country is located on the western periphery of the EU. Over the last decade however, this situation has started to change, and, according to an estimate, the number of foreign researchers increased to 5% of all researchers working in Portugal (Pereira, 2009) following on from the CIENCIA 2007 and CIENCIA 2008 programmes, which provided a significant number of post-doc grants. Naturally, most of these foreign researchers were allocated to junior positions. In the most recent years, due to the decline in the number of post-doc grants being offered, this fraction is probably declining again.

3.2.7 Education and training systems

The Portuguese higher education sector has improved in many respects over the last few decades. The number of students studying has risen fast, although it is still below the EU average. Universities and polytechnics (which are considered to be non-university higher education) have developed both through the establishment of new entities and the diversification of the supply in specialised areas. Some of the newer universities have become key stakeholders in the regions where they are located. Nevertheless, the creation of programmes in the areas of S&T and engineering has been limited. This has occurred because the institutions perceive that there is a weak demand for these disciplines. Students tend to prefer other areas, and, to a certain extent, tend to avoid maths and the "hard sciences", but this is mainly because they consider the job prospects in these areas to be limited. These facts do not preclude the country from having some high quality engineering and science schools, both in the main universities and also in some of the polytechnics. The engineering schools of both the universities of Lisbon and Porto have recently been ranked among the best engineering schools in the world, according to the

2014 “Best Global Universities Rankings” (see the news respectively for Técnico and FEUP on these hyperlinks).

The fact that a generous flow of funding for science has been made available over the recent decades has allowed some of these entities to develop a strong research capability, which ultimately will reflect in better curricula and the development of advanced postgraduate programmes. This trend has been reinforced by an increasing offer of PhD grants, although this policy has become more selective recently, due to both budgetary and labour market difficulties.

With regards to the orientation of the higher education sector as a whole towards those skills for which there is a rising demand in the labour markets, namely for the capacity to learn and to develop transversal competences such as critical thinking, problem solving, creativity, teamwork, and intercultural and communication skills, and yet the existing policies or legal frameworks do not incorporate incentives to bring about the necessary transformation. The managerial paradigm that has been dominant is still focused on quantitative and monetary aspects, and not so much on the qualitative aspects mentioned above.

Furthermore, despite higher education institutions being well aware of the “third mission”, this is still not sufficiently integrated in formal incentives and in evaluation procedures. Some universities are active in promoting initiatives for entrepreneurship (such as providing training, nurturing new ideas, incubators etc.), and in most cases they possess knowledge transfer offices which have been active in seeking IP protection and licensing. This has not materialised however in a solid culture of coordinating curricula with economic and social needs, neither in providing students with a formal education in these matters. The blame, however, does not lie so much with the higher education institutions themselves, as this situation stems more from the lack of proper incentives and the absence of a dynamic private sector which interacts and makes requests on the academic side.

3.3 ERA priority 5: Optimal circulation and access to scientific knowledge

3.3.1 e-Infrastructures and researchers electronic identity

The main research e-infrastructure in Portugal is b-on, the Online Knowledge Library, which was established in April 2004. It was initially managed by FCCN, which is now part of FCT. b-on allows an unlimited access for researchers in universities and research organisations to international scientific publications, through subscriptions that are negotiated by the Portuguese government with all the major main publishers of international peer-reviewed academic journals. Researchers from the following institutions that participate in b-on have full access to the contents of these publications: Higher Education Institutions, Associated Laboratories, Public Labs, Public Administration, Non-Profit Research Organisations, and Hospitals. Portugal is currently paying €40.6m to the publishers of the contents of b-on over the 3 year period of 2013- 2015. Presently b-on offers full access to 22,592 journals and 9,493 proceedings. In 2013, a total of 3.7m searches were conducted in b-on, with over 9.0m downloads.

In 2008, the Scientific Open Access Repository of Portugal (RCAAP) was established. RCAAP coordinates and facilitates the access to individual repositories of all subject material collected by universities and other research entities. The key objectives of RCAAP are as follows: to increase the visibility, accessibility and dissemination of Portuguese scientific research, and; to facilitate management and the access to information regarding the national scientific production, through the registration of scientific literature in specific information systems and their aggregation on the RCAAP portal. The RCAAP portal is the main result of the RCAAP project. This online portal gives access to thousands of scientific and scholarly publications, namely journal articles, conference papers and thesis and dissertations, all of which are provided by several Portuguese repositories.

In 2013, FCT decided to promote the registration in the ORCID registry of all those Portuguese researchers integrated into research units funded by FCT. ORCID offers a digital identifier which allows for the identification of each individual researcher. Registration on the ORCID portal was a precondition in order that researchers' output could be accounted for within the evaluation exercise of the national research units that was carried out by FCT in 2013 and 2014. Following on from this registration, researchers were requested to download their scientific output on the ORCID portal. This decision taken by FCT can be regarded as a possible step towards replacing the previous repositories of scientific production, such as the DeGóis curricula platform.

The DeGóis system (link accessed on 24 February 2015), which was established in 2003, offers a registry system where researchers could upload information on their profile, academic activities, prizes and awards, scientific productions and projects. DeGóis operates as a tool for gathering, supplying and analysing the intellectual and scientific production of Portuguese researchers. It allows for the search of curricula, according to content-related queries. With the objective of identifying the scientific domains of researchers' study, DeGóis allows for the establishment of relations between scientific productions and the OECD's Fields of Science table. By applying this international standard, the intention was to make it possible to compare the Curriculum DeGóis with other models originating from other scientific communities.

The decision to require registration with ORCID was taken in connection with using SCOPUS as the main database for the bibliometric evaluation of the research carried out by all the research units funded by FCT. These decisions by FCT were generally accepted, although some criticism was voiced. A group of prominent researchers (mainly in the area of computer science) published a statement in February 2014 (link accessed on 24 February 2015), which points out that there was a real decline in the use of ORCID, which by nature is an open system, with the exclusive consideration of research accounted for by SCOPUS, a proprietary system. The possible limitations of using just one type of bibliometric data source in an evaluation exercises is a subject that will have to be taken into consideration in the near future, as part of an attempt to balance the trade-off between costs and the fairness of FCT evaluations.

3.3.2 Open Access to publications and data

A national policy on open access started to emerge before the end of the last decade. The main measure was the establishment of RCAAP in 2008, as reviewed in the previous point of this report. RCAAP played a role in increasing the visibility of Portuguese research

through the availability of outputs on the Internet, whilst it also stimulated the development of open-access repositories in individual research entities in Portugal.

More recently, after launching a public consultation on this issue, FCT made public two documents in May 2014. The first of them regards an "Open Access Policy for Scientific Publications Stemming from FCT-funded R&D Projects", and the second one is a "Policy for Managing and Sharing of Data and Other Results Arising from FCT-funded Research" (both links accessed on 24 February 2015). Whilst the former defines the general principles regarding open access, the second one sets out the guidelines to be followed in for data resources. The general assumption of these documents is that the results of research funded by public resources should be made widely available, and that access to them should be free. The policy on open access that was adopted requires that "all publications of research outputs, subject to peer-review, or another form of scientific review, should be deposited in one of the open access repositories hosted within RCAAP as soon as possible, preferably immediately on acceptance for publication. An embargo period is allowed, after which the full content of the publications should be made freely available, at no cost. The policy applies to papers in scientific journals, conference proceedings, posters, books and book chapters, monographs and Masters and PhD theses."

In accordance with this document, open access to the full content of the publications should be made available as soon as possible, although an embargo period is acceptable. This period can have a maximum duration of twelve months for refereed papers in the social sciences, humanities or arts, and six months for refereed papers and publications in all the remaining scientific areas. Furthermore, FCT recommends authors to protect their intellectual property rights by applying a license to access and re-use which is compatible with the new policy, including through a Creative Commons license. In relation to the 'Publication Processing Costs' demanded by some publishers from authors, these can be reimbursed as direct or indirect costs within FCT-funded projects or research units, on the condition of full access for the respective publications being granted, and after a CC-BY Creative Commons license has been applied for. These costs should not however go above "a value that will be established and updated according to the evolution of international best practices in policies on open access."

The Portuguese policy on open access can therefore be classified as "hybrid open access", in the sense that there are elements of the "green open access" model (researchers are requested to archive their published article or the final peer-reviewed manuscript in an online repository before, after, or alongside its publication, and an embargo period is allowed), together with elements of "gold open access" model (the payment of publication costs is shifted from readers, via subscriptions, to the funding agency).

A recent study (Archambauldt et al., 2013) provided an examination of open access in Europe and in four other countries. A sample of publications registered in Scopus over the period of 2008-2011 was screened for this effect. In the Portuguese case, out of a sample of 1,047 papers, 479 were classified as "green or hybrid open access", and a further 97 were classified as "gold open access". This means that about 55% of the Portuguese publications during that period were within the open-access regimes, while for the EU28, the equivalent proportion is lower (45%).

The second document, which defines the policy on the management and sharing of data stemming from FCT-funded research, encourages researchers "to share primary data and other data with the scientific community, by placing the data in open access databases (such as Genbank, for example), within the shortest time possible."

A possible problem of the new policy on open access is its enforceability, at least at the beginning of its implementation, as researchers are not fully informed, or they may choose to publish without granting open access, as the fees imposed by some publishers may be higher than that which is deemed as being considered “reasonable” by the funding agency

4. Innovation Union

4.1 Framework conditions

The Framework conditions in Portugal are not very conducive to business investment in research and innovation. The austerity programme implemented over the last three and a half years, which will continue to be pursued (with limited easing) in 2015, together with significant restrictions in bank lending, especially to SMEs, has made firms' lives very difficult. Faced with these constraints, companies have followed a two-pronged attitude. One has been an increased focus on international markets to escape from the decline of the domestic market, and the other has been a more cautious financial stance, saving money to compensate for the difficulties in accessing credit. The first attitude had mixed implications for investment in research and innovation. Whilst the moves towards developed and Asian markets required an increase in the commitment to innovation, in order to be up to the international competition, those addressed to Portuguese-speaking markets, namely in Africa, did not rely so much on innovation. The rationale has been very much the replication of approaches already followed in the domestic market, often with some adaptations. The second attitude (a more cautious financial stance, whilst making firms more aware of the opportunities for process innovation), had a negative effect on firms' propensity to invest in R&D. This is manifested in the gradual decline of the BERD/GDP ratio, between 2009 and 2012: from 0.75% to 0.68 %.

It is important to recognise, however, that there has been a policy commitment to promote R&I by firms, expressed by the continuation and extension of the R&D tax credit system (SIFIDE II), even under harsh budgetary conditions, and also by the set of measures aimed at fostering R&I, both at individual and collaborative levels, under the CFOP/ 'Compete' framework. Initiatives in this regards have been very positively evaluated. It was found that they have induced enhanced collaboration and have also promoted companies' commitment to R&I (IESE/Quaternaire, 2013; Augusto Mateus & Associados/PwC, 2013). Public policy for supporting innovation and internationalisation, under the 2007-2013 NSRF, "has reached a high level of maturity, in terms of fine-tuning, integration, and diversity of instruments" (IESE/Quaternaire, 2013: 9). However, the increase in cooperation between companies and R&D organisations has not yet been strong enough to ensure an irreversible structural change (Augusto Mateus & Associados/PwC, 2013). According to the evaluation carried out by IESE/Quaternaire (2013), the fields in which the achieved results are less positive concern the following: insufficient support for the demonstration and dissemination of the results of R&D programmes; the gap between the financing instruments for the incubation of technology-based projects and promoters' needs, and; the excessive dispersion and lack of critical mass of technology-based incubation facilities.

The process of policy formulation is improving, thus enabling an increased participation of stakeholders, as shown by the recent formulation of a R&I strategy for Smart Specialisation. There is also an emerging culture of programme evaluation, which is to a large extent fostered by European Commission requirements. In this context, the initiatives by the NSRF Observatory to promote evidence-based policy formulation are worth mentioning. It would be desirable for the new Development and Cohesion Agency (AD&C) (in which that Observatory was integrated) to follow a similar approach.

However, over the last three years, the emerging interaction between supply and demand-side policies and instruments has suffered. In fact, in part due to budgetary constraints, the present government has discontinued, or significantly curtailed, several demand-side innovation initiatives that were launched before 2011, namely in the fields of electric mobility and renewable energy (Godinho & Simões, 2013). This has been a negative development, bearing in mind the need to use public policy as an instrument for fostering innovative change. The 'Coalition for Green Growth', which was created in February 2014, may play a role in promoting the combination of demand and supply-side initiatives with regard to environmental issues and sustainability. However, no specific initiatives have been announced or launched so far.

4.2 Science-based entrepreneurship

In 2014, no major policy measures have been launched in this respect. As mentioned in our previous report (Godinho & Simões, 2014b), the government launched the '2014-2020 Industrial Development Strategy for Growth and Employment' (Estratégia de Fomento Industrial para o Crescimento e Emprego 2014-2020) in November 2013, which supports science-based entrepreneurship initiatives, as mentioned as an important policy tenet.

Several initiatives were taken by Portugal Ventures in 2014, regarding ignition and support for business angels (see below). Although the Government's commitment to promote entrepreneurship is undeniable, and has been expressed in the design of the Strategic Programme on Entrepreneurship and Innovation (+E+I), and also in the revision of public venture capital organisations, it appears that less emphasis has been put on policy initiatives in this field. In the context of the 2007-2013 NSRF, measures have also been launched to promote knowledge-based entrepreneurship, to encourage university spin-offs, and to foster the development of venture capital and business angels.

Portugal Ventures, the public venture capital organisation, has launched an 'Ignition Programme', which involves three main axes: (1) calls for entrepreneurship, which attracted over 600 applications, around 40 of which were supported; (2) ignition networks (Ignition Partners Network, with 45 deal flow partners, and Ignition capital network, which encompasses 15 investment partners), and; (3) Portugal ventures abroad, with three accelerators in the USA (Boston, San Francisco, and Austin). A recently launched programme is the +Inovação +Indústria (+Innovation +Industry), which is in line with the Governments' initiative on Reindustrialisation. The purpose is "to invest in the creation of new companies in the context of traditional industries, betting on innovation as a differentiating factor, to increase global competitiveness, as well as to generate economic wealth and employment" (http://www.portugalventures.pt/). Although not exclusively addressed to science-based entrepreneurial initiatives, this programme is likely to spur such initiatives, bearing in mind its focus on innovation, and the fact that it concerns not just manufacturing industry, but also related services, such as R&D services, engineering and process development, the environment, integrative services, design, marketing (including digital marketing), and logistics.

With regards to the support to Business Angels, a new financing line was opened in 2014 to encourage operations by Business Angels. This line has two main objectives: to contribute to promoting entrepreneurship, and; to stimulate the creation of new companies and the launching of innovative projects, by providing seed and early stages capital. The line is restricted to companies which are majority-owned and managed by at least three

Business Angels, whose investment policy is focussed on seed capital and early stages with at least five years' duration. The overall amount assigned to this financing line is €10 million.

For a long time, public support has been provided to science and technology parks, and also to technology and innovation-based incubators. In the 2007-2014 NSRF, this kind of support was transferred to Regional OPs, which are managed by regional authorities. There is a plethora of business incubators facilities, many of them without the size and the know-how necessary to provide a relevant service for start-ups, and unable to generate a relevant demand for their services. This problem has been highlighted, as pointed out in 4.1 above, by the evaluation of innovation and internationalisation policies in the context of the 2007-2013 NSRF (IESE/Quaternaire, 2013). There are, however, a few very successful examples of incubation facilities, including the Coimbra-based Instituto Pedro Nunes, which has won several international awards.

The promotion of science-based entrepreneurship is an important facet of the support system that is to be established as a sequence to the new Partnership Agreement, Portugal 2020, which will run between 2014 (however, it is yet to be launched at the time of writing) and 2020.

Science-based entrepreneurship will be mainly supported in the context of the CIOP. This will be addressed through two approaches: (1) under the Specific Objective 3 of Investment priority 1.1 (Strengthening of the R&I infrastructure and the capacity to achieve excellence in R&I, and the promotion of competence centres, including those of European interest) of Thematic Objective 1, and; (2) under Specific Objective 1 (Promoting skilled and creative entrepreneurship) of Investment priority 3.1 (Promotion of entrepreneurial spirit) of Thematic Objective 3 (Strengthening SMEs' competitiveness). In the context of approach (1), there is a reference to the objective of promoting spin-offs from public research organisations. With regard to approach (2), four sets of measures are envisaged: (i) strengthening entrepreneurs' support networks (technical support, shared services…); (ii) strengthening the initiatives aimed at identifying, stimulating and supporting the launching of new companies and businesses; (iii) developing start-up innovation and growth strategies, namely through the support to business angels networks and venture capital initiatives, and; (iv) development of collective initiatives carried out by entrepreneurship support organisations, involving, *inter alia*, the provision of mentoring and coaching services during the first years. It is still too early to know exactly how these initiatives will materialise, as the specific support measures are still being developed. However the set of envisaged measures suggests the existence of a commitment to promote entrepreneurship and an encompassing perspective of start-up needs, which goes beyond the provision of financial support. Nevertheless, available evidence does not enable one to assess how these initiatives will interact with the support to Science and Technology parks and incubation facilities.

Measures to promote science-based entrepreneurship have also been disclosed in the Portugal 2014 NRP, in the framework of the "emblematic initiative" of the 'Programme of Knowledge and Technology Transfer towards Companies'. These include the development of incubator facilities and of business accelerators (Biz.pt, in cooperation with the University of Texas at Austin, and BGI, for technology-based firms), as well as the launch of the 'FCT Seed' contest, which is aimed at promoting the business exploitation of research findings by the beneficiaries of FCT project research grants. It is yet to be seen

how such initiatives will be combined with the abovementioned policy measures in the context of CIOP.

4.3 Knowledge markets

Portugal has had a network of IPR support services in place for several years. The GAPI (Industrial Property Support Offices) network was launched in the late 1990s by INPI, the National Institute for Industrial Property. The network was intended to increase awareness about Industrial Property Rights (IPR) among researchers and business people. GAPIs were established in several universities, technological centres and business associations and they have played an important role in encouraging the use of IPR, in disseminating patent information, and in providing basic support services regarding IPR applications. However, as a result of the crisis, many GAPIs were merged with the OTICs (Technology Transfer Offices in universities and polytechnics), with a view to saving resources and gaining scale. Unfortunately, the end of public support for the initiative, together with budgetary constraints faced by public bodies, including INPI, led to the weakening, and even the closure of these support organisations. According to the INPI website at present 23 GAPIs still exist. Meanwhile, INPI continues to support the network, and to provide information and training services on IPR management, and INPI launched a digital newsletter on IPR developments three years ago, and also a new service of Pre-Diagnosis of Technology Mapping.

With regards to the policies and instruments in place for developing knowledge markets for patents and licencing, the evidence is extremely limited. Up until the last decade, there was no active approach to technology and knowledge commercialisation by Portuguese firms and research institutions. The IPR protection activity was carried out by specialised lawyers, but their role was mainly in preparing and submitting patents and other IPR applications to both the national and international bodies that provide IPR protection. This situation started to change with the creation of the GAPI and OTIC networks, mentioned in the paragraph above. The setting out of UTEN (University Technology-Enterprise Network) in 2007, which was a joint undertaking with the University of Texas, Austin, aimed to provide services for the commercialisation of research outputs. It developed a professional technology transfer and commercialisation network in Portugal, oriented towards international markets. These initiatives contributed to changing the perspective of universities and other research institutions in relation to knowledge commercialisation. In 2011-2012, an initiative was launched with a view to generating a virtual market for technology. The +E+I Office had worked on this initiative, under the guidance of a former Secretary of State for Entrepreneurship and Innovation. However, for several reasons (namely Government change, the decline in +E +I activity, and troubles regarding the survival of AdI, the Innovation Agency), this initiative never fully materialised. On the business side, some firms are working on the matching of supply and demand in the market for technology, but with very limited resources and with relatively weak international connections.

The CIOP makes reference to the development of the market for knowledge. Under the Specific Objective 2 of Investment priority 1.1b (Promotion of Business Enterprise R&D investment) of Thematic Objective 1, there is a reference to support for “industrial property patenting and licensing” (Governo de Portugal, 2014b: 52). However, there is no specific reference to the market for technology. It is expected that ANI, the recently created Agência Nacional de Inovação, will play a role in this regard.

4.4 Knowledge transfer and open innovation

The development of the cooperation between academia and industry has long since been a concern for Portugal's R&I policy makers. However cooperation has been limited, for several reasons, ranging from institutional conditions (namely the low level of inter-personal and inter-organisational trust), through to the lack of systemic policy approaches to deal with the issue and the characteristics of Portuguese companies (which are mainly focussed on low knowledge-intensive activities) and universities (several of which have little concern for industry needs and requirements) and the low incentives for universities' staff to follow dual careers.

The creation of the GAPI network since the late 1990s, and of the OTIC network since 2003, have been already mentioned above. Whilst the latter was mainly focused on the university system, the former was wider-ranging, with several units encompassing technological infrastructures and business associations. While the funding for these two types of entities has been severely reduced during the past years, many of them have kept operating, and the rest were reformed and integrated in a new institutional set up. The UTEN network, which was set up in 2007, in cooperation with the University of Texas at Austin, under the context of agreements between Portugal and US Universities, relied to a large extent on the tangible and intangible assets of these two previous networks. As pointed out above, the mission assigned to UTEN was to "provide services for the commercialisation of research outputs". In the most recent years, UTEN "has been involved with early-stage Portuguese companies and young entrepreneurs, helping them with their plans to enter foreign markets [...] companies that are now in European and U.S. markets have clearly benefitted from their prior involvement in UTEN [...]. The challenge is now to further capitalise on developed networks and commercial successes by taking advantage of those skills, networking, and competences previously developed" (UTEN 2013 Annual Report). Table 2 provides information about the outcomes of the activities of existing TTOs in Portugal.

Table 2: Knowledge Transfer Policies – indicators regarding TTOs

Indicator	**2007**	**2011**
Total Patent applications	71	69
EPO Patent applications	12	6
R&D Agreements	187	252
Aggregated licensing income (K Euro)	257	643
Invention disclosures	133	282

Source: UTEN Portugal Progress Report 2012.

UTEN has addressed the recommendations of the evaluation of the agreements between Portugal and the US universities carried out by the Academy of Finland. These include the launching of an international business hub in Austin, Texas for incubating and accelerating Portuguese technology ventures. In accordance to the UTEN 2013 Annual Report, "these ventures will benefit from physical co-location space and feet-on-the-ground mentorship in Austin, from an experienced team of business developers, focusing on company expansion and growth".

The 'Compete' OP of the 2007-2014 NSRF included several measures which address knowledge transfer and the cooperation between different entities of the innovation system. These measures mainly concerned the promotion of cooperative R&D projects, namely the 'Co-promotion R&D Projects', similar to earlier measures such as R&D consortia, to stimulate R&D partnerships between S&T organizations and companies, and 'Collective R&D', which encompasses R&D projects promoted by employers' associations and implemented by S&T organisations, selected on the basis of an application call, to respond to problems shared by a relevant group of companies (Godinho & Simões, 2010). The launching of the 'Competitiveness and Technology Poles' (CTPs) clustering initiative played also a positive effect, although unbalanced in terms of the actual capability to enhance cooperative initiatives (SPI, 2012). There has been a wide convergence of the recent evaluations about the merits of these initiatives. Some observers have argued that the 2007-2014 NSRF, namely through 'Compete', has been able to create new conditions for increased cooperation (Mamede, 2012). The evaluation on the contribution of the NSRF towards company innovation and internationalisation has highlighted that new firms, namely SMEs, carrying out R&D activities comes about mainly through cooperation with R&D organisations (IESE/Quaternaire, 2013. 41). The report on 'Compete' indicates contains similar findings, pointing out that this programme has enabled an increased closeness between companies and R&D organisations; however it warned that the improvements achieved are not tantamount to a structural change in partners' behaviours. This means that new initiatives in this regard are needed, desirably to build upon and improve the policy measures launched under the 2007-2013 NSRF.

Awareness of this issue has led the Government to assign the strengthening of the collaboration between companies and the National Scientific and Technological System as being a key element of Agência Nacional de Inovação – ANI's mission. This is expected to contribute to improving the situation in this regard. However, the present economic context is not appropriate for enhancing companies' commitment to increase investment in R&I activities, for the reasons mentioned in 4.1 above.

A look at the 2014 NRP, and also at the CIOP, provides some hints about the likely development of this initiative over the next years. The main "emblematic initiative" under the 2014 NRP with a likely effect in this regard is the abovementioned 'Programme of Knowledge and Technology Transfer towards Companies'. Besides the reference to the focus assigned to ANI, the following measures involving University-Industry cooperation are mentioned: (1) Doctoral Programmes proposed by consortia between companies and Universities/R&D organisations; (2) participation in Horizon 2020, and; (3) the promotion of Entrepreneurship within public Higher Education and R&D organisations. However, as was mentioned in 2.3 above, these initiatives suffer from a supply-side approach, whereby the needs and involvement of companies has been granted insufficient attention.

The analysis of CIOP (Governo de Portugal, 2014b) indicates that policy measures will be addressed for the following: (1) strengthening the transfer of scientific and technological knowledge to companies, namely through the diffusion of those R&D results achieved by R&D organisations throughout the industrial fabric, and the strengthening of the role of R&I infrastructures as interface organisations, with a view to economic valorisation of knowledge; (2) the participation of Portuguese organisations, including firms, in Horizon 2020, and the dissemination of the R&D results stemming therefrom; (3) networking activities by R&D infrastructures (although the main focus concerns inter-infrastructure cooperation); (4) increasing the number of projects involving cooperation between companies and public research organisations; (5) strengthening clustering initiatives, and;

(6) cooperation to undertake pre-competitive collaborative R&D projects. There is a focus on the activities in line with the national smart specialisation strategy. As in previous rounds of European support, increased incentive rates are likely to be granted to company R&I initiatives undertaken in cooperation with R&D organisations. However, available information does not enable one to know exactly how this will take place. An interesting feature of the new round of the 2014-2020 European support, which is likely to have a positive effect in stimulating the cooperation between academia and industry, is the possibility of providing financial support for R&D projects simultaneously through Horizon 2020 and Portugal 2020 and this might be able to leverage the Portuguese participation in Horizon 2020.

No measures have been taken, or are anticipated, to provide incentives for, and to reward academics engaged in cooperation with industry/users. As mentioned in earlier Country Reports for Portugal, the revision of the ECDU, the University Teaching Career Statute, did not go far enough in this regard (Godinho & Simões, 2009), and no revision of such statutes is envisaged. The initiatives taken with a view to encouraging the circulation of knowledge between both academia and the private sector and within the private sector fall under the 'Programme for Knowledge and Technology Transfer towards Companies', and the clustering initiative. Since their highlights have already been presented in earlier sections, they will not be detailed here.

4.5 Innovation framework for SMEs

Insolvency regulations were revised in 2012 in the context of the 'Revitalise' programme, which was aimed at reducing red tape and at putting a stronger emphasis on company recovery. The recovery of the bankruptee is envisaged as being more relevant than the recovery of credit. Therefore, the purpose is to aim at maintaining the bankruptee in business, whilst the bankruptcy process is underway. According to the rationale for this new law, the distinction between the recovery of credit, and ensuring the economic and financial viability of a company, is an essential trait of this revision. It is argued that such a distinction will help avoid the stigma associated with bankruptcy, even though the debtor is under recovery.

Under the 2007-2014 NSRF, and more specifically the CFOP/'Compete', Portugal had a wide spectrum of policy measures aimed at improving the business environment for innovation-oriented SMEs. Besides SIQPME, which was an incentive system for promoting investment projects aimed at SME innovation, modernisation and internationalisation (see Godinho & Simões, 2009), other measures were implemented to promote cooperative R&D projects involving SMEs and R&D organisations, namely the Co-promotion projects, and the Collective R&TD projects launched by business associations. Other measures for encouraging R&D activities by SME include the R&D Teams and R&D Centres, which are aimed at providing financial support for SMEs to set up and enlarge in-house R&D capabilities. Another type of measure, launched under 'Compete', is the Innovation and R&TD vouchers scheme, which finances the recourse by SMEs to innovation and R&D services. Still under 'Compete', there was also a programme on 'Collective Efficiency Strategies', which encompassed the clustering initiative by creating and supporting a set of Competitiveness and Technology Poles (CTPs). A measure for training-action for company managers was also launched under the Human Potential Operational Programme (HPOP).

This wide array of measures enabled a differentiated approach, which addressed the specific needs of companies. The evaluations undertaken over the last year of the contribution of NSRF and 'Compete' towards the improvement of innovation (IESE/Quaternaire, 2013; Augusto Mateus & Associados/PwC, 2013), whose main findings have been presented on section 2.7 above, converge in a positive assessment of the effects of the policy mix for fostering companies', namely SMEs', innovation. The tone has, however, been different with regard to the evaluation of the clustering initiative (SPI, 2013). A significant variance has been found among the performance of the various CTPs, and the launching of a new process of selection and qualification of clusters was suggested.

With regard to administrative procedures, the assessment is also positive and improvement in transparency and the quality in the selection process has been pointed out. There is, however, still a need to reduce red tape and to streamline procedures, in order to ensure faster decision times. With this regard, the commitment taken by the Portuguese authorities in the context of the Portugal 2020 Partnership Agreement is to ensure that the process of application analysis and decision should not exceed 60 working days.

This leads to the new support framework for 2014-2020, namely the CIOP. Available evidence based on the Portugal 2020 Partnership Agreement and the CIOP suggests that the approach to support SME innovation will build upon the previous experience, whilst trying to introduce incremental improvements to existing measures. Based on available evidence, it seems that the main changes will concern the following: (1) the introduction of a stronger emphasis on knowledge and technology transfer measures; (2) a thorough revision of the clustering initiative; (3) an increased focus on supporting the SMEs product and process development capabilities, and; (4) a stronger commitment to training-action support for SMEs. While the first suffers, as pointed out above, from a supply-side bias, the others are, in our view, most welcome, especially the strengthening of training-action initiatives. These are likely to have a very positive effect on the upgrading of SMEs.

4.6 Venture capital markets

Public According to the Innovation Union 2014 (European Commission, 2014b), Portugal's relative performance in terms of Venture Capital investments has been 77, which is below the EU average. This is not surprising, bearing in mind the limitations of Portugal's capital markets and its domestic market size (Godinho & Simões, 2011). Furthermore, the venture capital business is relatively young in Portugal and is not mature. In spite of public initiatives aimed at promoting venture capital companies and business angels, including the restructuring of public venture capital instruments and the creation of Portugal Ventures, the trend is, according to the IUS 2014, slightly negative (-3.7%).

With regards to Business Angels (BAs), the recently published EBAN Statistics Compendium (EBAN, 2014) provides a more positive picture. According to this source, Portugal was ranked 9th in terms of the number of BAs, and the average investment per BA was €22k, which is very close to the figures exhibited by Spain and Germany. Portugal is mentioned among those countries which have exhibited a positive trend.

As mentioned in previous reports, since the late 1980s, there have been several public policy initiatives aimed at promoting the development of venture capital markets and, more recently, of BA networks. This has involved tax policy, but mainly the granting of

specific financing support, under the successive Community Support Frameworks (see, for instance, Godinho & Simões, 2014a). Since 2011, there has been an increased policy commitment to entrepreneurship, and therefore to support to venture capital and BAs initiatives. Such support has been provided namely through the financial instruments axis of CFOP/'Compete', following the headlines set up by the Strategic Programme on Entrepreneurship and Innovation (+E +I Programme).

The main policy measure has been the restructuring of the various public venture capital bodies to create a new venture capital organisation: Portugal Ventures. As pointed out in earlier reports, Portugal Ventures' mission highlights that its investments should be mainly addressed to "innovative, scientific and technology based companies, as well as to companies from the more traditional tourism and industrial Portuguese sectors, with significant competitive advantages and export oriented to global markets" (link accessed on 24 February 2015). As mentioned in 4.2 above, Portugal Ventures has launched an 'Ignition Programme', with three strands: calls for entrepreneurship; ignition networks, namely the Ignition Partners Network, with 45 deal flow partners, and the Ignition capital network, encompassing 15 investment partners; and Portugal Ventures abroad, with three accelerators in the USA. Another recent initiative of Portugal Ventures is the +Inovação +Indústria (+Innovation +Industry), which is aimed at contributing towards the Government intention to foster reindustrialisation. The initiative is focussed on innovation, and is addressed to both the manufacturing industry and related services, such as R&D services, engineering and process development, the environment, integrative services, design, marketing (including digital marketing), and logistics.

With regard to the support to Business Angels, the launching in mid-2014 of a new financing line of €10 million to encourage operations by Business Angels in the fields of seed and early stages capital deserves a reference. This line is aimed at promoting entrepreneurship and to contributing to the setting up of new companies and the launching of innovative projects. The beneficiaries from this measure are companies which are majority-owned and managed by at least three Business Angels, whose investment policy is focussed on seed capital and early stages with at least five years' duration.

According to the 2012 EVCA benchmarking study on the tax environment for the private equity and venture capital industry (EVCA, 2013), Portugal provides a dedicated structure for these activities, however, some restrictions may apply. The activities of Venture Capital Companies are regulated, and these manage Venture Capital Funds, some of which may be specifically addressed to industries or to a level of company maturity. In 2013, capital gains were taxed at a rate that could reach 31.5 per cent (a basic rate of 25%, plus municipal and state surtaxes) (EVCA, 2013:155). However, the basic rate was reduced to 23% in 2014, and will further decline for 2015. Furthermore, the Budget for 2015 provides taxes incentives for very young companies. There are fiscal incentives at fund level, whereas at company level, fiscal incentives are only granted for R&D expenditures. The benchmark analysis tables suggest that Portugal is situated in the middle of the league with regards to the tax environment for private equity and venture capital investments.

Concerning the future developments in the context of Portugal 2020, and namely of the CIOP, support to venture capital and BAs will be continued, and probably increased. However, the specific measures in this regard are not available yet. Our research indicates that the design of the policy measures will be based on the findings from the ongoing evaluation of the Financial Instruments under the 2007-2014 CFOP/'Compete'.

4.7 Innovative public procurement

The In recent years, concern with the use of public procurement as an instrument to promote innovation has clearly declined. The demand-side initiatives taken in the context of the Technological Plan, namely for renewable energy, electric mobility and public sector innovation, have, to a large extent, been discontinued.

A new organisation in charge of public procurement was established in 2012: the Entidade de Serviços Partilhados da Administração Pública, I. P. (eSPap, the Institute for Public Administration Shared Services). eSPap's mission was defined as follows: "to ensure the achievement of efficiency and effectiveness gains, through a rational use of common public resources and the supply of shared services, thereby contributing towards the agility of the state and the country's sustainable development".

In a recent statement, the President of eSPap underlined the relevance of ICT towards the improvement of eSPap's activity. He argued that in the past there has been an important investment in the digitalisation of public services. In his opinion, the challenge nowadays is to ensure the interoperability of such systems, the development of pre-commercial procurement, and the establishment of new organisational forms and connectedness solutions.

There is the intention to revise the National Strategic for Ecologic Public Procurement, which had been previously defined in 2007. The main changes will, according to available information, concern the enlargement of priority products and the inclusion of new fields, for instance, food products. These changes are expected to be a driver for the creation of new markets.

5. Performance of the National Research and Innovation System

5.1 Performance of the National Research and Innovation system

On average in 2012, Portugal produced 16.8 publications per 10,000 inhabitants, which is below the EU-28 average (52.8). These publications have an international orientation, with 47.93% of publications being co-published internationally. In 2012, Portugal had about 803 international scientific co-publications per million of population. This performance indicates the country is in the group of those EU member states that have a higher international orientation, although it is still at a distance from the Nordic countries, Belgium or the Netherlands. Slightly less than 11% of the Portuguese scientific publications were in the top 10% most cited publications worldwide in the period from 2002-2012, which is equal to the overall EU28 performance for this indicator (Science Metrix, 2014).[6] The share of public-private co-publications in Portugal is 1.1% during the period of 2008-2013, against 2.8% for the EU28.[7]

The analysis of Table 3 confirms the view that Portugal ranks better in terms of inputs than outputs. The capacity to transform investments undertaken to enhance innovation enablers is below the EU average. Indicators regarding human resources (New doctorate graduates [ISCED 6] per 1,000 population aged 25-34, and Percentage population aged 25-64 having completed tertiary education) are not very far from the EU average and this reflects the level of investments made to enhance the development of human resources. This is also expressed in the research output indicators (International scientific co-publications per million population, and Scientific publications among the top 10% most cited publications worldwide as a % of total scientific publications of the country), particularly international scientific co-publications, which is much above the EU average.

In contrast to the performance as measured by scientific publications, Portuguese performance with regards to patenting is much below the equivalent values for the EU, as shown in Table 3. Around 901 patent applications from Portugal were lodged at the EPO during the period of 2000-2010 and approximately 918 applications took the PCT route during the same period. Whilst statistics about applications to national patent offices are not always comparable across countries, they do nevertheless provide some indication of those technological development activities that are not captured by EPO or PCT data. Approximately 2,595 applications were received by INPI, the national patent office, in 2000-2010.[8] The gap vis-à-vis the EU average also increases for economic effects (Portugal's performance for Medium and high-tech product exports as a % of total product exports, and License and patent revenues from abroad as a % of GDP is significantly below EU average).

[6] These publication data are based on Elsevier's Scopus database. ScienceMetrix, Analysis and Regular Update of Bibliometric Indicators, study conducted for DG RTD. They represent an update of the data displayed in the table below. See also http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=other-studies.

[7] Scival 2014, Scopus based publication indicators derived from Elsevier's SciVal platform, www.scival.com, last accessed in December, 2014.

[8] The figures in this paragraph are based on fractional counting, and its source is a a study carried out by KU Leuven and Bocconi University called "Patents and Licensing study", for DG RTD, released in the Summer of 2014.

Table 3: Assessment of the Performance of the National Research and Innovation System

1. ENABLERS	Year	PT	EU
Human resources			
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2011	1.60	1.70
Percentage population aged 30-34 having completed tertiary education	2012	27.20	35.80
Open, excellent and attractive research systems			
International scientific co-publications per million population	2012	761.21	343.15
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	2009	9.85	10.95
Finance and support			
R&D expenditure in the public sector as % of GDP	2012	0.68	0.75
Venture capital (early stage, expansion and replacement) as % of GDP	2012	0.05	0.08
2. FIRM ACTIVITIES			
R&D expenditure in the business sector as % of GDP	2012	0.70	1.31
Linkages and entrepreneurship			
Public-private co-publications per million population	2011	16.97	52.84
Intellectual assets			
PCT patent applications per billion GDP (in PPS€)	2010	0.62	3.92
PCT patent applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	2010	0.18	0.85
3. OUTPUTS			
Economic effects			
Contribution of medium and high-tech product exports to trade balance	2012	-0.28	1.27
Knowledge-intensive services exports as % total service exports	2011	30.09	45.26
License and patent revenues from abroad as % of GDP	2012	0.02	0.59

Source: European Commission, IUS Database (2014).

It is important to recognise that it takes time to translate investments in education into economic outputs. The process is not a fast one, meaning that a time lag is required for such investments to have economic consequences. This is particularly evident in the case of science-based entrepreneurship. The issue is, however, more complex, as such translation is very much dependent on the structure of the business fabric and also on the existence of a set of science-driven firms, as well as on the patterns of University-Industry interaction (Mamede, Godinho & Simões, 2014; Godinho, 2012; Simões, 2012; Mamede, 2014). Without changing such structure and patterns, upstream investments will not materialise into economic outputs. The significant gap in the number of applications for patents between Portugal and the EU average (in 2011, Portugal's PCT applications per billion Euros GDP correspond to about 17% of the EU average), although this reflects a very low patent propensity, it is also a consequence of an economic structure in which the

weight of science-based industries (those which exhibit a higher propensity to patent) is very limited. The gap is much lower when trademark applications are also considered.

Taking these arguments into account, it is not surprising to find that license and patent revenues from abroad as a percentage of GDP are little more than 3% of the EU average. Similar reasons apply for the case of the share of medium and high-tech product exports as a percentage of total product exports. However, in some traditional industries, particularly in footwear, there has been evidence of a significant capability to enhance the technology and knowledge content of exports (Mamede, Godinho and Simões 2014).

5.2 Structural challenges of the national R&I system

The analysis The identification of the main challenges faced by the national R&I system was based on a diversified set of sources, including the following: the 2014 Innovation Union Scoreboard and similar initiatives, such as the COTEC Innovation Barometer (COTEC, 2013); the 2013 EU Industrial R&D Scoreboard; the Innovation Union Competitiveness Report, 2013; the ERA Progress report; Portugal's 2014 NRP; the European Council recommendations regarding R&I policy; the SWOT exercise carried out by FCT (FCT, 2013); the evaluations of the 2007-2013 NSRF dealing with R&I issues; the analysis of the Portugal 2020 Partnership Agreement and the CIOP; recent developments in R&I policy in the country, and; authors' reflection on the development of Portugal's R&I system and the developments ahead. Several structural challenges were identified, and bearing in mind the orientation of adopting a structural perspective, it comes as no surprise that most of the challenges are similar to those identified for 2013 (Godinho & Simões, 2014). However, two new challenges were identified which need to be addressed by public policy. These have to do with the cohesiveness of the research system and with the risk of too long an interim period before the new Portugal 2020 Partnership Agreement will achieve cruise speed. A brief account of such challenges is provided below:

- **Ensuring the sustainability of the research and innovation system**: Portugal had, since the 1960s, a policy to promote the training of young scientists abroad. This was strengthened after the late 1980s, following Portugal's entry into the European Economic Community, when it profited from the allocation of structural funds. Meanwhile, research policy management capabilities have developed incrementally, with block and extra competitive funding instruments being made available to support advanced academic research. Several programmes were launched to stimulate the establishment of research consortia between academic research centres and industrial companies. Though this cooperation has faced different problems (see other challenges referred to below), research activities on the business side, as measured by BERD, grew swiftly up until 2009. Such growth, in part fuelled by very generous tax incentives to R&D, has not been sustained, as shown by the most recent R&D statistics. The present economic climate and challenges do not enable one to anticipate a recovery in the near future, in spite of the increased fund allocation for R&D activities, as a result of the new round of structural and cohesion funding. Prospects are no better for the Higher Education sector. Since the outset of the crisis (Godinho & Simões, 2013), conditions have deteriorated with regards to the activity of the R&I system, increasing the potential for an irreversible loss of critical mass, due to a dynamic emigration of highly-skilled researchers (Sistema de Segurança Interna, 2013).

- **Keeping the trend of improving strategic policy design, systemic density and coordination among the R&I system players**: Traditionally there has been a divide between research and innovation policies (Caraça, 1999; Godinho & Simões, 2005; Cooke&Simões, 2003). This has been a major hindrance for the quality and consistency of the research and innovation system which was also recognised by the recent SWOT analysis undertaken by FCT (FCT, 2013). In the recent past, several initiatives were implemented to bridge such a divide, namely a new structure for policy responsibilities under the 2007-2013 NSRF, and a new approach to inter-ministerial collaboration, namely between the ministries for Education and Science and for the Economy. The initiative to design a R&I strategy for Smart Specialisation is also a good example of participatory involvement from different stakeholders, as well as of collaboration between national and regional bodies. However, in spite of these improvements, a structural and irreversible change has not yet been achieved. More efforts are needed in this regard. The challenge is compounded by the limited involvement of the various stakeholders, notably companies involved in the process of designing R&I policy (Cooke & Simões, 2013; Godinho & Simões, 2013; Godinho, 2013). The very low level of 'Public-private co-publications per million of population in Portugal' (see table above) is a good indicator of this situation. Strengthening systemic density requires the strengthening of interactions among the players in the system. The launching of cluster policies, namely the CTP - Competitiveness and Technology Poles, was meant to foster the cooperation among various stakeholders. However, in spite of several achievements, it fell short of expectations, particularly in some fields. An additional concern, which to a certain extent is related to the sustainability challenge highlighted above, is how to deal with the difficulties in financing public and university research as an opportunity to strengthen the linkages with company capabilities and needs. This requires appropriate initiatives to encourage the circulation of people and ideas between companies and research centres.
- **Maintaining the levels of cohesiveness and dialogue among the players in the research system, whilst improving the levels of trust and capacity to collaborate in challenging endeavours**: This challenge is closely related to the previous one, and needs to be addressed by public policy. The root of the problem is to some extent a consequence of the low levels of trust which characterise Portuguese society (Godinho, 2012). This interacts with other factors, namely the low level of stakeholder involvement and the traditional centralisation of policy design. The experience of assigning increased relevance to regional OPs and the establishment of a policy network for managing the 2007-2013 NSRF were all positive developments (Cooke & Simões, 2013; Augusto Mateus & Associados, 2010). These will be most likely pursued under the Portugal 2020. However, in spite of the positive experience of establishing the R&I strategy for Smart Specialisation, the reasonable consensus previously existing in the research front is now at stake. The problems that occurred with the process and the decisions regarding the last calls for 'FCT Investigator', and for the research grants and the present evaluation of R&D units, all indicate that such consensus has been put in jeopardy. There is a clear need for an evaluation and for a reorganisation of the system. Unfortunately, however, the process has not been managed in a transparent and participatory way; this is likely to create a distrustful climate, with detrimental consequences for the development and maturation of the research system.

- **Implementing the Smart Specialisation approach in a consistent manner, while avoiding a supply-side bias**: As mentioned in previous Country Reports (Godinho & Simões, 2012, 2014), Portugal's research policy has followed a horizontal approach, without discriminating between research fields. The rationale for such a policy was that Portugal's scientific underdevelopment had to be addressed through a broad, generic research policy. This has led to positive developments. However, since the late 2000s, this approach has started to change, for two main reasons. Firstly, Portugal has reached a status which in many regards is close to, or even above, the EU average, as is the case of "New doctorate graduates", or "International scientific co-publications" (see the table above). Secondly, budgetary constraints demand a more focussed approach to escape from a dispersion of public funds and to promote economies of scale in research. Furthermore, this is in line with the Smart Specialisation perspective. This policy change has been translated into the definition of the five thematic axes of the R&I strategy for Smart Specialisation: Cross-cutting technologies and applications; Manufacturing technologies; Mobility, space and logistics; Natural resources and environment; and Health, well-being and tourism. These thematic axes are broad enough to encompass a wide set of research areas. It is expected that specific calls for thematic research projects will be launched under the CIOP. This will correspond to a significant, and positive change, vis-à-vis previous policy orientations. It is important to state, however, that while prioritisation may bring important potential gains, there is a risk of sub-optimal choices due to lobbying, or lack of strategic intelligence. Hence, there is a need for good governance processes. Another risk, especially bearing in mind the disclosed initiatives on 'technology transfer' policy, regards the supply-side bias in research policy. The demand side needs to be taken into account, to escape the trap of assuming that the university has the knowledge, whilst the business sector just applies it. It is critical to combine the body of understanding (a characteristic of university activities) with the body of practice (a characteristic of company activities), and to stimulate unexpected creative encounters (Cooke & Simões, 2013). As put in the Country Report 2013, "such an interaction is much more promising than the misleading, linear model-based concept of 'technology' transfer, which is so widespread in national (and European) policy approaches" (Godinho & Simões, 2014).
- **Achieving a fast regulation of the policy measures under the Portugal 2020 Partnership Agreement, to avoid an excessive length of implementation of the key measures addressed to the players in the R&I system (including the reorientation of clustering initiatives)**: This challenge does not have a systemic nature like the others do, being somewhat short-termed. However, this is a very important challenge, as the delay in getting a final agreement on the CIOP and a late implementation of its measures risks putting in jeopardy those achievements reached under the 2007-2013 NSRF, and of excessively delaying firms' investment decisions in a time when access to bank financing is difficult and investment is badly need to achieve a sustained recovery. Therefore, it is important to provide conditions that can enable companies to have access to CIOP and regional OPs funds as soon as possible.
- **Stimulating the emergence of new companies, both domestic and foreign-owned, particularly in knowledge intensive activities**: A negative feature emerging from the 2014 Innovation Union Competitiveness Report is the low share of employment in knowledge intensive activities in Portugal (about 65% of the EU average). Whilst there has been a recovery in recent years, the pace is too slow (0.3% per annum) to ensure structural change (European Commission, 2014b). A committed

effort is needed for Portugal to become competitor in more knowledge intensive areas. This would require, not only the promotion of domestic skilled entrepreneurship and the development of already established knowledge-based firms, but also the attraction of knowledge-intensive inward investment (Mamede, Godinho & Simões, 2014). A committed, long-term strategy is required. The focus on a more internationally competitive tax system, including a gradual decline in corporation tax and the creation of a tax office to provide advice to international investors are not sufficient. In fact, the kind of investment needed to upgrade the industrial fabric and to foster structural change is not motivated only by tax considerations (Tavares-Lehmann, Coelho & Lehmann, 2012). Other aspects, such as the quality and availability of skilled manpower, the quality of local suppliers, and the institutional framework (bureaucracy, efficiency of the legal system) are often more relevant. Success in attracting foreign investment requires a very professional and consistent implementation, the development of research organisations and suppliers, and the definition of priority activities and sectors. This is essential in order to build a reputation in this field. The policy orientations suggested above are consistent with the Smart Specialisation strategy.

- **Strengthening the development of SMEs in-house technological, organisational and marketing capabilities, with a view to make them more prepared to compete in international markets**: The education levels of the Portuguese population are lower than the EU average: the share of population in the 30-34 age group, which has completed higher-level education is 76% of the EU average, whilst the share of the population in the 20-24 age group with upper secondary level education is 84% of the EU average (European Commission, 2014b). This is reflected, *inter alia*, in companies' capabilities. Managerial capabilities are limited, especially in traditional industries. The need to enter international markets, particularly through exports, makes the strengthening of in-house capabilities an increasing demand. This issue has been recognised in innovation policy statements and was translated into a few initiatives aimed at contributing to enhancing SMEs' innovation capabilities. An interesting example was the NITEC programme, aimed at supporting the setting up of dedicated R&D teams in firms. There is, however, a need to pursue and improve such programmes, since they are essential to enhance SMEs' competences to innovate and to compete in international markets. There is a positive interaction between the innovation and internationalisation capabilities at company level (Quaternaire Portugal & IESE, 2013). There is an agreement that the focus on technological capabilities, though relevant, is not sufficient. It should be combined with initiatives to promote organisational and marketing capabilities. These are important for the development of innovative approaches for enabling companies to improve their performance in international markets. According to the information available, these issues will be addressed by the CIOP and the Regional OPs, including the strengthening of training-action programmes to foster managerial capabilities.

Table 4: Policy measures addressing structural challenges in Portugal

Challenge	Key issues
1. Ensuring the sustainability of the research and innovation system	• Consolidating earlier achievements • Assigning a stronger political priority to research and innovation • Fighting the deterioration of research conditions • Promoting firms' R&D
2. Keeping the trend of improving strategic policy design, systemic density and coordination among the R&I system players	• Improving governance • Building upon earlier positive initiative to encourage coordination • Promoting firms' participation in policy design • Improve the working of the cluster initiative
3. Maintaining the levels of cohesiveness and dialogue among the players in the research system, whilst improving the levels of trust and capacity to collaborate in challenging endeavours	• Create conditions to increase the trust levels among the R&I system players • Improve policy implementation in a participatory way
4. Implementing the Smart Specialisation approach in a consistent manner, whilst avoiding a supply-side bias	• Pursue the thematic approach stemming from the identification of Smart Specialisation priorities • Avoid a supply-side bias in R&I policy • Promote University-Industry collaboration on an equitable basis
5. Achieving a fast regulation of the policy measures under the Portugal 2020 Partnership Agreement, to avoid an excessive length of implementation of the key measures addressed to the players in the R&I system.	• Fast launching of R&I policy measures under CIOP and Regional OPs • Fast decision regarding the reorientation of the clustering initiative
6. Stimulating the emergence of new companies, both domestic and foreign-owned, particularly in knowledge intensive activities	• Promote entrepreneurship • Promote company spin-offs • Attract skill-intensive Foreign Direct Investments
7. Strengthening the development of SMEs in-house technological, organisational and marketing capabilities, with a view to making them more prepared to compete in international markets	• Keep and improve the measures on R&D teams and R&D centres in companies • Keep the measures on cooperative R&D projects involving SMEs • Promote the development of SME managerial capabilities • Promote training-action initiatives specifically addressed to small companies' characteristics.

5.3 Meeting structural challenges

As pointed out in earlier reports, the R&I policy mix is reasonably comprehensive (Godinho & Simões, 2009, 2010, 2013 and 2014). A similar view has been expressed by the independent evaluation of the impact of the 2007-2013 NSRF in the fields of innovation and internationalisation (IESE/Quaternaire Portugal, 2013). The set of measures provided

by the 2007-2013 NSRF was generally appropriate, addressing the main challenges identified. The field where the mix has more shortcomings is still, in our opinion, the provision of managerial support to SMEs. However, as was pointed out above, CIOP and regional OPs envisage measures aimed at improving the quality of policy support.

Therefore, the main bottlenecks to the response of the challenges identified are not so much associated with 'holes' in the set of specific measures, but more with more systemic issues. The efficiency and effectiveness of the policy mix has been seriously undermined by three main types of problems.

The first is the still insufficient coordination among the different sectorial policy perspectives. Although some improvements have taken place in recent years, a systemic approach to tackle these challenges is still lacking. A systemic approach to research and innovation is still lacking. In fact, the design and implementation of research and innovation policies has not been steered at the highest political level.

The second difficulty is related to the dominance of a 'linear model' perspective (Godinho, 2012; Laranja, 2012; Simões, 2012). In fact, in spite of some improvements stemming from the policy mix of the 2007-2013 NSRF (Mamede, 2012), the idea that investment in science and in the 'transfer' of scientific knowledge to companies is the key to ensure an innovation based competitive approach is still dominant, especially among research policy makers. Politicians seem to lack a clear view about the systemic nature of the innovation process, and still do not realise the importance of the non-technological dimensions. In this regard, the envisaged 'technology transfer' initiatives are not likely to contribute to significantly improve the performance of the R&I system, for the reasons explained in 5.2 above.

There are also institutional issues (Godinho, 2013). Institutional weaknesses undermine the working of the R&I system. Research and innovation activities are collaborative processes which demand appropriate links and collaborative networks among the players. The low level of interpersonal trust limits the depth and breadth of collaborative endeavours and this becomes a widespread barrier for both the implementation of systemic, integrated and participated policy approaches, and also for appropriate and consistent implementation, as has been highlighted above.

Policy implementation has been another weak link. Although several improvements have been made, companies continue to complain that the process is still too bureaucratic (Quaternaire Portugal & IESE, 2013: Annex 6). This reduces the take up by the target players. The transfer of competences to regional authorities by several measures introduced an additional administrative burden, with implications for implementation. However, the experience has proved to be generally positive, as it enabled the development of a better dialogue between applicants and the administration, thereby easing the process (Cooke & Simões, 2013).

The intermediate evaluation of the 2007-2013 NSRF (Augusto Mateus & Associados, 2010) suggests that the implementation machinery improved with regards to earlier CSF rounds and it notes, however, the need to improve some aspects, namely better project follow-up. On the other hand, the financial crisis raised further problems for implementation, since matching funding traditionally provided by banks has been significantly curtailed. The Portugal 2020 Partnership Agreement puts emphasis on the reduction of red tape and in streamlining procedures to achieve a maximum delay between

project application and decision of 60 working days. However, only future experience will show whether these intentions have turned into reality.

Several independent evaluations of various aspects of the 2007-2013 NSRF have already been carried out (Augusto Mateus & Associados, 2010; IESE & Quaternaire Portugal, 2011; IESE/Quaternaire Portugal, 2013; SPI & Inno TSD, 2013). As pointed out in the 2013 Country Report (Godinho & Simões, 2014), the first two are mainly concerned with implementation and less with effectiveness. Although both evaluation exercises provide a positive assessment, they agree in stressing the advantage of adopting a more well-defined strategic perspective towards the policy mix. An interesting and positive finding regards the fact that while tangible investments keep the majority share in the investments supported, there has been increased room for intangible investments. This has also been pointed out in the report on the impact of the 2007-2013 NSRF on innovation and internationalisation performance (IESE/Quaternaire Portugal, 2013).

This latter report provides a positive assessment of the role played by the 2007-2013 NSRF in the fields of innovation and internationalisation. The main findings are the following: (1) the incentive system has reached a high level of maturity, drawing upon a systemic concept of competitiveness, and has been focussed on promoting companies' capabilities, as well as on collective initiatives; (2) there has been a co-evolution of companies' capabilities in innovation and internationalisation; (3) the approach has been, however, much more appropriate for the more advanced cohesion regions of the Norte and Centro, rather than for the Alentejo and the Algarve; (4). the incentive system is broadly appropriate, and should not be significantly changed in the next programming phase. This evaluation highlights some areas for improvement, namely: the financing of start-ups; public policy intermediation through the involvement of industry associations; the dissemination of results throughout the economic fabric, and; clustering initiatives.

These clustering initiatives, labelled as Collective Efficiency Strategies, have been subject to a specific evaluation (SPI & Inno TSD, 2013). The evaluation has a somewhat critical tone, stressing the existence of a gap between initial intentions and reality. Several recommendations are mentioned in response to this problem, namely the launching of a national medium term clustering policy was suggested, which adopts a more selective stance. The establishment of appropriate links between clustering, R&I and territorial policies in connection with Smart Specialisation strategies was also highlighted. Available evidence indicates that the clustering initiative will be subject to significant revisions for the 2014-2020 programming period. Their headlines have not been disclosed so far, although it is likely that the recommendations of the evaluation will be taken into consideration in many respects.

Annex 1 – References

Archambault E., Amyot D., Deschamps P. et al (2013), *Proportion of Open Access Peer-Reviewed Papers at the European and World Levels–2004–2011*. Publ Science-Metric Inc, Montréal, Canada.

Augusto Mateus & Associados (2010). *Avaliação Intercalar do QREN*. Lisbon: Augusto Mateus & Associados.

Augusto Mateus & Associados/PwC (2013). *Avaliação Intercalar do COMPETE*. Lisboa

Caraça, João (1999), 'Ciência e Mudança', in M.M. Godinho and J. Caraça (orgs.). *O Futuro Tecnológico*. Oeiras: Celta.

Cooke, P. and Simões, V. C. (2013), *Final Report on Portugal*. DG RTD Expert groups advising on development of Smart Specialisation strategies in the EU 12 plus Greece, Portugal & Spain. Brussels: European Commission.

COTEC Portugal (2013), Barómetro de Inovação, Innovation Digest. Lisbon: COTEC and Everis (link accessed on 24 February 2015).

EBAN (2014), *EBAN Statistics Compendium*. Brussels: EBAN.

European Commission (2014a). COMMISSION STAFF WORKING DOCUMENT *Assessment of the 2014 national reform programme and stability programme for PORTUGAL*, Accompanying the document "Recommendation for a COUNCIL RECOMMENDATION on Portugal's 2014 national reform programme and delivering a Council opinion on Portugal's 2014 stability programme", {SWD(2014)423 final}. Brussels: European Commission.

European Commission (2014b). *Innovation Union Scoreboard 2014*. Brussels: European Commission.

European Council (2014). *COUNCIL RECOMMENDATION of 8 July 2014 on the National Reform Programme 2014 of Portugal and delivering a Council opinion on the Stability Programme of Portugal, 2014* (2014/C 247/20).

EVCA (2013). *2012 Pan-European Private Equity and Venture Capital Activity* - Activity Data on Fundraising, Investments and Divestments.

FCT (2013). *Diagnóstico do Sistema de Investigação e Inovação – Desafios, Forças e Fraquezas rumo a 2020*. Lisboa: Fundação para a Ciência e Tecnologia.

FCT (2014). *An analysis of the Portuguese Research and Innovation System: Challenges, strengths and weaknesses towards 2020*. Lisboa: Fundação para a Ciência e Tecnologia (available at https://www.fct.pt/esp_inteligente/docs/SWOT_FCT_2013_En.pdf

Godinho, M. M. (2012). 'Análise e caracterização do sistema de investigação e inovação em Portugal: Dinâmicas institucionais e falhas sistémicas', presentation to the workshop organised by FCT «O Sistema Nacional de Investigação e Inovação: Desafios, forças e fraquezas rumo a 2020». Lisbon, 11-12, December, 2012.

Godinho (2013). *Inovação em Portugal*. Lisboa: Fundação Francisco Manuel dos Santos.

Godinho, M. M. and Simões, V. C. (2005). *R&D, Innovation and Entrepreneurship 2007-2013*, Report for the QCA/CSF Observatory. Lisboa: ISEG.

Godinho, M. M. and Simões, V. C. (2009). *Erawatch Country Report 2011: Portugal*, JRC/IPTS, Luxemburg: European Communities.

Godinho, M. M. and Simões, V. C. (2010). *ERAWATCH Country Reports Portugal 2009*. Brussels: European Commission (link accessed on 24 February 2015).

Godinho, M. M. and Simões, V. C. (2011). ERAWATCH Country Reports Portugal 2010, Brussels: European Commission (link accessed on 24 February 2015).

Godinho, M. M. and Simões, V. C. (2012). ERAWATCH Country Reports Portugal 2011, Brussels: European Commission (link accessed on 24 February 2015).

Godinho, M. M. and Simões, V. C. (2014a). ERAWATCH Country Reports Portugal 2012, Brussels: European Commission (link accessed on 24 February 2015).

Godinho, M. M. and Simões, V. C. (2014b). ERAWATCH Country Reports Portugal 2013, Brussels: European Commission (link accessed on 24 February 2015).

Governo de Portugal (2013). *Estratégia Europa 2020: Ponto de situação das metas em Portugal*. Lisboa: Governo de Portugal.

Governo de Portugal (2014a). *Portugal 2020: Acordo de parceria 2014-2020.* Julho de 2014, Lisboa: Governo de Portugal.

Governo de Portugal (2014b), Programa Operacional da Competitividade e Internacionalização, Lisboa: Governo de Portugal, December (link accessed on 24 February 2015).

Governo de Portugal (2014c). *Estratégia Europa 2020: Ponto de situação das metas em Portugal, Abril de 2014*. Lisboa: Governo de Portugal.

Governo de Portugal (2014d). *Estratégia de Investigação e Inovação para uma Especialização Inteligente – EI&I* https://www.portugal2020.pt/Portal2020/Media/Default/Docs/EstrategiasEInteligente/ENEI_Vers%C3%A3o%20final.pdf

Governo de Portugal (2014e). Despacho Conjunto de 23 de Dezembro de 2014, http://www.iapmei.pt/resources/download/Despacho_P2020.pdf

IESE/Quaternaire (2013). *Avaliação estratégica do Quadro de Referência Estratégico Nacional (QREN) 2007-2013*. Lisboa: Observatório do QREN.

Laranja, Manuel (2012), 'Os sistemas regionais de inovação e a territorialização das politicas públicas', presentation to the workshop organised by FCT «O Sistema Nacional de Investigação e Inovação: Desafios, forças e fraquezas rumo a 2020», Lisbon, 11-12, December, 2012.

Mamede, R. P. (2012), 'As redes de circulação de conhecimento em Portugal: Padrões de interacção e actores-chave nos sistemas de apoio do QREN', presentation to the workshop organised by FCT «O Sistema Nacional de Investigação e Inovação: Desafios, forças e fraquezas rumo a 2020», Lisbon, 11-12, December, 2012.

Mamede, R. P. (2014), Structural challenges, innovation performance, and the rope of innovation policies in Portugal, Report prepared for the High-level Economic Policy Expert Group 'Innovation for Growth', January.

Mamede, R.P., Godinho, M.M. and Simões, V.C. (2014), Assessment and challenges of industrial policies in Portugal: is there a way out of the 'stuck in the middle' trap?, in

Structural Change, Competitiveness and Industrial Policy: Painful Lessons from the European Periphery, Aurora A.C. Teixeira, Ester Silva, Ricardo Paes Mamede (Eds.). Routledge, Taylor & Francis Group.

Pereira, Tiago Santos (2009), 'Carreiras de investigação e carreiras docentes ou uma única carreira académica?', *Ensino Superior – Revista do SNESup*, 33, pp. 27-31.

ScienceMetrix, 2014, Analysis and Regular Update of Bibliometric Indicators, study conducted for DG RTD, see also http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=other-studies

Simões, V.C. (2012), 'Os recursos do sistema de I&I: O problema da conversão', presentation to the workshop organized by FCT «O Sistema Nacional de Investigação e Inovação: Desafios, forças e fraquezas rumo a 2020», Lisbon, 11-12, December, 2012.

Sistema de Segurança Interna (2014), Relatório Anual de Segurança Interna 2013 (link accessed on 24 February 2015).

SPI/Innov TSD (2013), Sociedade Portuguesa de Inovação and Inno-TSD, *Estudo de avaliação da estratégia e do processo de implementação das estratégias de eficiência colectiva tipologia clusters*. Lisboa: Observatório do QREN.

Szulanski, Gabriel (2003), *Sticky knowledge: barriers to knowing in the firm*, Thousand Oaks: Sage.

Tavares-Lehmann, A.T., Coelho, A., and Lehmann, F. (2012). Taxes and foreign direct investment attraction: a literature review, pp. 89-11, in Rob Van Tulder, Alain Verbeke, Liviu Voinea (Eds.), *New policy challenges for European multinationals* (Progress in international business research, Volume 7), Emerald Group Publishing Limited.

Annex 2 – Abbreviations

AdI	Innovation Agency
ANI	National Innovation Agency
BERD	Business Expenditures for Research and Development
CFOP	Competitiveness Factors Operational Programme (short name: COMPETE)
CIOP	Competitiveness and Internationalisation Operational Programme
COMPETE	Competitiveness Factors Operational Programme
COTEC	COTEC Portugal - Associação Empresarial para a Inovação
CRUP	Conselho de Reitores das Universidades Portuguesas
CTP	Competitiveness and Technology Poles
DGEEC	Direcção-Geral de Estatísticas do Educação e Ciência
EC	European Commission
ECB	European Central Bank
ECDU	Statute of the University Teaching Career
EIPs	European Innovation Partnerships
ERA	European Research Area
ERA-NET	European Research Area Network
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
eSPap	Entidade de Serviços Partilhados da Administração Pública, I. P.
EU	European Union
EU 27	27 EU Member States (before Croatia joined the EU)
FCCN	Fundação para a Computação Científica Nacional
FCT	Science and Technology Foundation
FP	European Framework Programme for Research and Technology Development
FP7	7th Framework Programme
FTE	Full Time Equivalent
GAIN	Global Acceleration Innovation Network
GAPIs	Support Offices for Industrial Property Use
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GPPQ	Office for promoting national participation in the Framework Programme
HCOP	Human Capital Operational Programme
HERD	Higher Education Research and Development expenditures
H2020	Horizon 2020 - EU Framework Programme for Research and Innovation
IAPMEI	Agência para a Competitividade e Inovação
ICT	Information and Communication Technologies
IMF	International Monetary Fund

INL	Iberian International Nanotechnology Laboratory
INVOTAN	Comissão Coordenadora de Investigação para a OTAN (Portuguese commission for research within NATO)
IPR	Intellectual Property Rights
IPTS	Institute for Prospective Technological Studies
JRC	Commission's Joint Research Centre
MEC	Ministry for Education and Science
NRP	National Reform Plan
NSRF	National Strategic Reference Framework
OECD	Organisation for Economic Co-operation and Development
OPs	Operational Programmes
OTICs	Knowledge and technology transfer offices
NGO	Non-Governmental Organization
PhD	Doctor of Philosophy
QREN	Quadro de Referência Estratégico Nacional (National Strategic Reference Framework)
R&D	Research and development
R&I	Research and Innovation
RIS3	Research and innovation strategies for smart specialisation
SIFIDE	Sistema de Incentivos Fiscais à I&D Empresarial (Business R&D fiscal credits programme)
SME	Small and Medium Sized Enterprise
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
S&T	Science and technology
TO	Thematic Objective
UMIC	Agência para a Sociedade do Conhecimento

European Commission
EUR 27313 EN – Joint Research Centre – Institute for Prospective Technological Studies

Title: RIO Country Report Portugal 2014

Authors: Manuel Mira Godinho & Vítor Corado Simões

Luxembourg: Publications Office of the European Union

2015 – 63 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-49002-6 (PDF)

doi:10.2791/584

LF-NA-27313-EN-N

JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

Serving society
Stimulating innovation
Supporting legislation

doi:10.2791/584

ISBN 978-92-79-49002-6

Publications Office